Sporadic Bovine Encephalomyelitis: Etiologic Studies, Epizootiologic And Epidemiologic Implications†

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IN 1940, McNutt[1] described a disease of cattle which he named sporadic bovine encephalomyelitis. During the past four years, 22 outbreaks of this disease have been observed in South Dakota, Missouri, Kansas, and Oklahoma[2]. These outbreaks, involving paralyzed calves, aroused our interest because we were curious about possible relationship between sporadic bovine encephalomyelitis and poliomyelitis. Detailed field observations supported by laboratory studies have given us a fairly complete picture in regard to the disease and the infectious agent causing it.

Sporadic bovine encephalomyelitis has been observed in cattle in the midwestern and western United States. A survey of the published literature, and communications with state livestock sanitary officials and teachers in veterinary schools have provided data on geographic distribution of recognized cases[2]. The disease has been recognized in 11 states, namely, California, Idaho, Indiana, Iowa, Kansas, Maryland, Minnesota, Missouri, Oklahoma, South Dakota, and Texas. Undoubtedly, the disease has greater prevalence than is generally recognized.

Clinical Syndrome

Calves under six months of age were uniformly more susceptible to the disease than yearlings or adult animals. Morbidity rates among yearlings and older cattle averaged about 5%, whereas among calves the rate was 25%. Calves experienced greatest herd mortality, but observed case mortality was only 29%. When adult animals developed the disease, they had a case mortality of 38%.

Duration of the epizootic appeared to be related to herd immunity. Recruiting of susceptible calves into a herd when the virus was present but latent in clinical activity, was followed by abrupt and extensive outbreak lasting from two to four weeks.

In regard to the clinical disease, prodromal signs and symptoms were not evidenced, and none can be described. Onset in calves occurred with fever (105 to 107 F.), lack of desire to eat, depression, and inactivity. Nasal discharge was frequently present. There was increased salivation and drooling. Difficulty in breathing and associated cough were observed in approximately half of the sick animals. At the same time, diarrhea appeared; both mild and severe cases were observed, the stools watery and blue-gray. Within a few days, or at most two weeks after onset, calves had difficulty in walking. There was at first stiffness with knuckling of fetlock joints. Animals staggered, circled, and fell. There was retraction of the head into a position of opisthotonos. Finally, limbs were weak with apparent paralysis and affected animals were unable to rise.

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Pathologic Changes

Autopsies were made on 14 animals[3]. Peritonitis, serofibrinous in nature, was found. Early in illness, free, yellow, watery fluid was observed in the peritoneal cavity. Later, at a time when encephalomyelitis was clinically apparent, the exudate thickened and formed a fibrinous net enveloping the omentum and covering the surfaces of the liver and spleen. Delicate adhesive strands of fibrin bound the omentum to the spleen and liver, and the liver

Jersey calf (#22), female, two months of age. Sept. 24, 1951, paralysis of the hind limbs, slight diarrhea, cough, and temperature of 101.5 F. Onset Sept. 12, unable to follow dam in the pasture; Sept. 14, exhibited stiffness of the hind limbs; Sept. 18, developed definite paralysis, and was unable to get up on its feet. Autopsy Sept. 24, serofibrinous peritonitis, pleuritis, and pericarditis. C. B. herd, Adair, Mo.

to the diaphragm. The spleen may or may not have been enlarged. Fibrinous pleuritis was found in ten of the 14 animals. A yellow, watery pleural effusion may have been present. Pericarditis occurred grossly in seven animals. The pericardium was covered by a delicate fibrinous exudate similar to that seen in the pleural and peritoneal cavities. Other tissues were not remarkable in regard to gross appearance.

Microscopic findings demonstrated: (a) fibrinous serositis, involving the peritoneal, pleural, and pericardial membranes; and (b) diffuse and marked meningoencephalitis.

Serous membranes were involved in an acute and subacute inflammatory cellular reaction. At the time of death, or at autopsy, inflammatory reaction consisted of an outer layer of round cells, with occasional polymorphonuclear neutrophile and eosinophile cells, a central layer of necrotic tissue debris, and a basal layer adjacent to the tissue consisting of fibroblasts in active growth.

Histopathologic changes observed in the central nervous system were those of a diffuse inflammatory process which extended from cerebral cortex to lumbar cord. Lesions were suggestive of secondary changes following generalized vascular damage, and indicated sweeping injury in which all areas of the central nervous system appeared to be involved at the same time.

On microscopic examination, minute elementary bodies were found in mononuclear and spindle-shaped cells in exudates overlying the mesencephalon and spleen. These were difficult to find and were never numerous. Other micro-organisms were not found despite careful search by direct examination and cultural methods.

Etiology Studies

On experimental inoculation, visceral and brain tissues obtained from affected calves produced clinically apparent disease in guinea pigs. Tissue emulsions inoculated into the peritoneal cavity of guinea pigs resulted within three to six days in the appearance of a fibrinous peritonitis with associated enlargement of liver and spleen. Bloody serous fluid was sometimes found in the peritoneal cavity of infected animals; apparently it followed rupture of peritoneal blood vessels or tears in the capsule of liver or spleen. The infectious agent was passaged in series in guinea pigs, and following adaptation, in the yolk sac of developing chick embryos.

An infectious agent was detected in tissues obtained from each of eight calves and a cow[3]. The virus gave rise to recognizable clinical and pathologic changes in guinea pigs. Tissue extracts which produced disease in guinea pigs caused death of embryos after inoculation in the yolk sac of embryonated hens' eggs. Tissue emulsions prepared from experimentally infected guinea pigs and chick embryos were used to propagate the agent in series in experimental hosts.

Minute elementary bodies were found in the peritoneal exudate obtained from guinea pigs, and in the yolk sac obtained from infected hens' eggs. Elementary bodies were not easy to find, particularly in guinea pig exudate; they were more numerous in yolk sac preparations. Studies made on elementary bodies, using light and electron microscopy, relate them to the psittacosis-lymphogranuloma venereum group of viruses. The agent has a particulate size of about 375 millimicrons[3].

Experimental Disease in Calves

McNutt was able to reproduce the disease in series in calves by means of inoculation under the skin, into the abdominal cavity, or

into the brain. These studies were repeated by us in order to determine pathogenicity of the agent which had been isolated from infected cattle. Seven calves were inoculated with emulsions containing active virus. Initially, calves were inoculated with 1 ml. of the S strain intracerebrally. None of the animals developed clinical evidence of encephalitis, although five had fever (104 to 105 F.) and all had mild clinical signs of illness such as anorexia, weight loss, inactivity, lacrimation, and stiffness of gait. During the active clinical phase, each of the infected animals had a leukopenia, with depression of polymorphonuclear cell types and increase in the lymphocytic series. All recovered. Postmortem histology of animals which had received virus intracerebrally showed meningoencephalomyelitis. Animals inoculated in the peritoneal cavity developed serous peritonitis, perisplenitis, and perihepatitis. None of the animals inoculated intraperitoneally developed clinical or histologic evidence of encephalitis.

Sera were collected from animals periodically before and after inoculation. Five of the seven animals developed humeral complement-fixing antibodies in titers varying from 1:16 to 1:128 against the hemotypic strain.

Serologic Studies

In the course of the study, it was observed that the elementary bodies had many characteristics which relate them to the psittacosis-lymphogranuloma venereum group of viruses. This was further substantiated by the tinctorial qualities of the elementary bodies, their growth in the yolk sac of the embryonated egg, and the pathognomonic lesions produced by them in experimental hosts.

Serologic studies demonstrated specific rise in complement-fixing antibodies in serum obtained from monkeys, guinea pigs, and calves following experimental infection. Studies with these sera for neutralizing antibodies to lymphocytic choriomeningitis, western equine encephalomyelitis, eastern equine encephalomyelitis, and St. Louis encephalitis viruses failed to demonstrate their presence.

A year ago we sent two of the bovine encephalomyelitis virus (BEV) strains to the Microbiological Institute, Rocky Mountain Laboratory, Hamilton, Mont. Dr. David B. Lackman and Dr. Robert K. Gerloff have cooperated with us in a study to relate BEV to known members of the psittacosis-lymphogranuloma venereum group. Sera obtained from experimentally infected and naturally infected animals have been studied there. Findings to date indicate that BEV is a member of the psittacosis-lymphogranuloma venereum group. It is rather difficult to distinguish BEV serologically from typical psittacosis virus, since both antigens bind complement in high titer from serum containing either type antibody. Cross-absorption tests have not been completed.

Observations on Herd Infections

Observations made on natural outbreaks of sporadic bovine encephalomyelitis indicate: (a) that the name is misleading, since encephalomyelitis is incidental to a systemic infection in which every organ system is potentially, if not actually, at risk of insult by the infectious agent; and (b) that the increased susceptibility of calves less than six months of age, as compared with adult cattle, suggests that infection by the agent may be quite widespread and results in relative or absolute immunity in many adult cattle. Older cattle seldom contract the disease in the form described for calves, and, when they do, the herd mortality rate is one-seventh that of calves experiencing the disease.

Evidence in support of widespread distribution of the agent in body tissues is based on the pathological lesions which have been observed in affected calves. Somewhat more convincing evidence undoubtedly will be forthcoming in detection of the causative agent in various organ extracts. At the present time, nine strains of an infectious agent have been isolated in guinea pigs and in the yolk sac of developing chick embryos. Three of the nine strains have been found in pooled emulsions of liver and spleen, and seven of these have been found in emulsion of brain stem, cere-

Holstein calf (#2), female, eight months of age. Onset May 5, 1952, high temperature, slight diarrhea, nasal discharge. By May 20 the calf showed a definite paralysis of the hind limbs. Expired May 21. Autopsy May 22 revealed only congestion of the brain. E. N. herd, Millard, Mo.

bellum, and cervical spinal cord. In each instance, minute coccal elementary bodies, similar to those of the psittacosis-lymphogranuloma venereum group, have been found in the yolk sac of infected embryos.

Evidence recorded here indicates that the disease is enzootic over a wide area. Epizootics occur in herds containing large numbers of calves, and not infrequently outbreaks follow recruitment of susceptible calves into established herds. Under these conditions, spread of infection is apt to be swift and duration of herd illnesses is likely to span a period of four weeks. It has been observed that the disease has appeared in calves purchased from dealers and brought into the herd, whereas calves born within the herd of corresponding breed and age, remained healthy during the epizootic. There have been two exceptions where the disease smouldered along in the herd for six months and involved 30 to 46 calves and four of 65 adults. Epizootics have remained sharply localized to affected farms; during the period of the study, spread of the disease to neighboring herds in the community was not observed.

Nothing is known in regard to the natural means of spread of virus in a susceptible herd. Some facts previously published may be helpful. McNutt[4] infected guinea pigs with emulsions of liver, spleen, lymph node, and brain. Boughton[5] reported that urine and nasal secretions contain an unidentified infectious agent provoking peritonitis in guinea pigs. Clinical and pathologic evidence suggest widespread distribution of the virus in body tissues. McNutt and Boughton failed to infect guinea pigs with blood obtained from calves sick with sporadic bovine encephalomyelitis. It may be pointed out that these tests were done at a time quite late in the natural history of the disease; it appears to be quite likely that virus circulates in the blood. Recently we have found the virus in the blood of experimentally inoculated calves[15]. McNutt injected calves subcutaneously with infected tissue suspensions and reproduced the disease, which is suggestive that there is movement of virus in extracellular fluid compartments.

McNutt has also made the observation that susceptible calves seldom contract the disease when they are kept in close contact with diseased animals. It is our opinion that there are situations when this can not be true, particularly in view of the observed velocity of spread of the disease among calves newly introduced into a herd where the disease apparently is latent in clinical activity. Some evidence is available to suggest that milk from affected cows may be infectious. McNutt and Waller[6] observed two healthy calves develop encephalitis two weeks after receiving milk from an affected cow. In one herd studied by us, 16 calves were fed pooled milk obtained from 15 cows (two were sick); although 14 calves (of 16) were involved, the outbreak lasted 22 weeks, suggesting that infected milk was probably not the only medium requisite for dispersal of the virus[7]. To the best of our knowledge, virus has not yet been demonstrated in fecal droppings.

Discussion

The finding of bovine encephalomyelitis virus as a member of the psittacosis-lymphogranuloma venereum group adds another virus to the growing number in this group which have been discovered in recent years. Relationships of these, and their ability to produce disease in man, have, in most cases, been undetermined.

In addition to BEV, another virus has been isolated by York and Baker[8] from intestines and feces of apparently normal calves. This virus, named *Miyagawanella bovis,* closely resembles members of the psittacosis-lymphogranuloma group of viruses. Proof that this virus is similar to BEV has not been presented.

It may be of interest to note that Light and Hodes[9] isolated a filterable agent from human cases of infantile diarrhea; this agent regularly produced diarrhea in calves. The agent appeared to be a virus, but it was not identified.

McKercher[10] recently isolated a virus from sheep lung which he tentatively concluded was a new member of the psittacosis-lymphogranuloma-pneumonjtis group of viruses. The virus causes a pneumonia in sheep. Baker[11] also isolated a virus of this group which caused pneumonia in cats.

Birds primarily have been associated with psittacosis in man. Parakeets and pigeons apparently have accounted for most human psittacosis, but canaries, chickens, and ducks have also been incriminated. Irons, *et al.*[12] described an outbreak of psittacosis (ornithosis) among turkey dressers in Texas, occurring in November 1948. They mentioned that the importance of common barnyard birds in spread of psittacosis is probably frequently overlooked. Boney, *et al.*[13] isolated an agent from turkeys showing air sac involvement. Turkeys were from a flock that was suspected as a possible source of a second outbreak of psittacosis (ornithosis) among poultry dressing plant workers in Texas. The outbreak was encountered by Irons, *et al.*[13] in late 1951.

Rubin, *et al.*[14] isolated a psittacosis-like agent from the blood of snowy egrets in Louisiana. The virus was identified as a member of the psittacosis-lymphogranuloma group,

and was found to resemble closely the Louisiana pneumonitis (Borg) virus in host range and infectivity studies. The Louisiana pneumonitis (Borg) virus was isolated from human cases of severe pneumonitis which occurred in the bayou region of Louisiana[15].

Summary

A description of the disease sporadic bovine encephalomyelitis is given, including clinical syndrome, pathologic changes, and etiology. Observations on herd infections and the experimental disease in calves are presented.

Sporadic bovine encephalomyelitis is described as a specific disease syndrome of cattle caused by a visible filterable virus, identified as a member of the psittacosis-lymphogranuloma venereum group of viruses. Relationships of this virus to other members of the group, and its ability to cause disease in man, are as yet undetermined.

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Vaccine for Blue Tongue in Sheep Proposed

Dr. R. A. Alexander, director of veterinary services, Union of South Africa, has confirmed by observation and laboratory study existence of blue tongue in sheep within borders of the United States. Blue tongue is a virus disease transmitted by biting insects of the species culicoides; there is no evidence of animal to animal transmission by contact, or of transmission to man.

Approximately 325,000 sheep were infected in California last year, with losses estimated at 15,000 head. While many animals recover from the disease, loss due to wool and carcass quality deterioration is frequently great.

At the Onderstepoort Veterinary Laboratories, University of Pretoria, Doctor Alexander has been successful in producing and immunizing sheep with blue tongue vaccine. Authorities in this country are also exploring possibilities of commercial production of the vaccine. Attenuated vaccines can be produced by the egg-embryo method commonly employed for commercial production of other vaccines. There are several strains of the virus; however, experience in South Africa has shown that a mixture of several variants can be cultured to provide a single vaccine giving protection against as many as three strains.

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Experimenters have found that radioactive krypton contained in a balloon inflated in a dog's stomach, provided a safe, convenient method of suppressing gastric acidity. Further work is necessary before the procedure can be advocated in cases of peptic ulcer, but no contraindications have appeared.—*Proc. Soc. Exp. Bio. Med.*, 81:636 (Dec.), 1952.

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Hemophilus gallinarum has been isolated from swollen infraorbital sinuses of geese. Injected into ducks and certain other birds, it did not produce the disease, but was infective to other geese. *Vet. Bul.* 23:136 (April), 1953.

Continuous Phenothiazine Therapy For Horses

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A LONG-TERM study of low-level phenothiazine administration in horses was undertaken at this station in April 1948**. The experiment was planned to determine possible toxic manifestations and the therapeutic activity against the parasites harbored by horses. Initially, 12 horses were included in the study; however, at the end of both the first and second yearly observation periods, four horses were sacrificed for postmortem examination. During the first two years, the horses were divided into four groups and fed individually 0.5, 1, 2, and 4 gm. phenothiazine, respectively, in the daily grain ration. For the third year, the four remaining animals, one from each of the original four groups, received 2 gm. phenothiazine daily in the grain ration. Observations covering the three years of daily phenothiazine administration to these animals have been reported[2,5,6,7].

No manifestation of drug toxicity was noted in any of the animals during the three years of therapy. Monthly blood examinations gave no indication of an essential change in the blood picture, and no interference with reproduction resulted in any of the mares. Postmortem examinations of the eight animals at the end of the first and second years failed to reveal evidence of gross or microscopic pathology, ascribable to the drug, in any of the organs examined.

Significant reductions in the number of strongyles carried by the horses were reported at the close of both the first and second years of treatment. This was based on monthly fecal egg counts and the number of worms recovered from the animals sacrificed at the yearly intervals. Continued control of the strongyles through the third year was indicated by the persistent low or negative fecal egg counts.

Daily administration of 2 gm. of phenothiazine has been continued through an additional 12 months in the remaining four mares. The present report is concerned with periodic blood and fecal examinations made during this 12-month interval, together with a summary of the postmortem findings on two of the mares which were sacrificed at the close of this period. For comparison of the observations on the strongyles recovered from the latter animals, a similar collection and examination was made of the strongyles harbored by two mares which had been stabled and pastured with the treated animals during the last two years of drug administration. Neither of the control mares received phenothiazine during this period and both were sacrificed within one week of the treated mares.

A six-year-old mare that received 2 gm. of phenothiazine on her grain feeding daily for three years. This mare was successfully bred and foaled normally in the spring of 1950 and 1951.

Methods

The technics† employed for the monthly blood and fecal examinations have been outlined in earlier reports[5,6] on these animals. No change was made in the general care and feeding of the animals during the fourth year. At the close of this period, two of the mares

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**The investigation reported in this paper is in connection with a project of the Kentucky Agricultural Experiment Station and is published by permission of the director of the Station.

†The first three years and the initial phase of the fourth year of this study were completed under the direction of Dr. A. C. Todd who is now with the Department of Veterinary Science, University of Wisconsin, Madison.

(seven and 12 years of age, respectively) were sacrificed for postmortem examination for possible gross and microscopic pathology in the organs and to estimate the number of strongyles harbored by the animals. For the latter, the cecum, ventral colon, and dorsal colon were handled separately. Contents of a given portion of the large intestine, together with several water rinses of the mucosa, were mixed thoroughly and a minimum of 10% was removed as an initial sample. This, in turn, was subsequently mixed and several sub-samples constituting at least 10% of the initial sample, or 1% of the original contents, were examined to estimate the number of small strongyles (cylicostomes). A search was made routinely through the entire initial sample for members of the genus Strongylus. Following the removal of the contents, the entire large intestinal surface was examined for all strongyles which remained attached to the mucosa.

Results

Parasitological Observations

Monthly fecal examinations on the four mares during the fourth year of continuous phenothiazine administration are summarized in table 1. Negative examinations predominated and accounted for 85% of the observations. For one of the mares (12-year-old), no strongyle eggs were detected during this period. On seven occasions in which strongyle eggs were observed in the other mares, counts were of a low order, with 48 eggs per gram of feces being the maximum count recorded.

In view of the foregoing consistently low or negative fecal examinations, the number of strongyles collected from the two mares that were sacrificed was surprisingly high (table 2). Twenty-two mature specimens of the genus Strongylus were recovered from the large intestine of the 12-year-old mare. These included one male and five female *Strongylus vulgaris* attached to the ventral colon and an additional 16 *S. vulgaris* estimated in the contents of the ventral colon. Sixteen sexually immature *S. vulgaris* (bloodworms) were recovered from the anterior mesenteric artery. The number of small strongyles (cylicostomes) totaled 7,100, of which 31% were classed as immature larval forms on the basis of the presence of provisional buccal capsules.

In comparison with the foregoing mare, a relatively large number of large strongyles was recovered from the seven-year-old mare (table 2). Three species and a total of 592 specimens of the genus Strongylus were recovered from this mare. Only *S. vulgaris* was found in the cecum. Here, 62 males and 62 females were collected from the wall, while the remaining 320 were in the contents. In the ventral colon, only one male was attached to the mucosa. The remaining 60 were in the contents of the ventral colon along with 60 *S. edentatus*. From the wall of the dorsal colon, two female *S. vulgaris*, two male and one female *S. edentatus*, and one male and one female *S. equinus*, were collected. The 20 *S. vulgaris* in addition were in the contents of the dorsal colon. Twenty-seven sexually immature *S. vulgaris* were found in the anterior mesenteric artery. A total of 9,175 small strongyles were harbored by this mare, and 9.8% were larval forms.

The parasite collections from the two control mares are also presented in table 2. It will be noted that no members of the genus Strongylus were found in the control-1 mare, either in the large intestine or in the anterior mesenteric artery. However, a comparatively heavy infection (65,750) of small strongyles was harbored by this mare. Immature larval forms accounted for 10.2% of the total.

Three species of the genus Strongylus were recovered from the control-2 mare, but the total was well below the number found in the seven-year-old treated mare. Attached to the cecal mucosa were 11 male and 41 female *S. vulgaris*, two male *S. edentatus*, and three male and one female *S. equinus*. Cecal contents contained 50 *S. vulgaris* and five *S. equinus*. Only *S. edentatus* (seven male and 20 female) was recovered from the ventral colic wall, and large strongyles were not found in the dorsal colon. Five bloodworms were recovered from the anterior mesenteric artery. The small strongyles numbered 31,150 in this mare, and

TABLE 1. Monthly Fecal Examinations for Strongyle Eggs During Fourth Year of Daily Phenothiazine Administration (2 gm.).

Horse	Eggs per gram of feces on date indicated											
	5-28-51	6-29	7-26	8-28	9-26	10-30	11-28	12-27	1-31-52	2-28	3-27	4-24
8-Year-Old Mare	0	0	0	0	0	0	16	16	0	0	0	—
6-Year-Old Mare	0	0	0	0	0	0	16	48	0	0	0	—
7-Year-Old Mare	0	0	0	0	16	0	0	0	0	32	32	0
12-Year-Old Mare	0	0	0	0	0	0	0	0	0	0	0	0

in close agreement with the control-1 mare, 8.9% were immature larval forms.

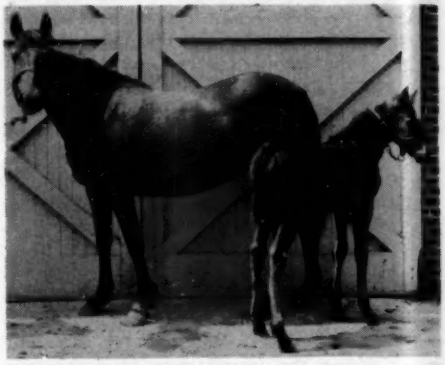
Both large and small strongyle females from both the phenothiazine-treated and the control mares were examined microscopically after fixing and clearing for the presence of eggs *in utero*. None of the adult females of the genus Strongylus from either of the mares that had been on low-level phenothiazine were observed to contain eggs *in utero*. Included in this study were five female *S. vulgaris* from the 12-year-old mare, and 86 female *S. vulgaris*, two female *S. edentatus*, and one female *S. equinus* from the seven-year-old mare. In contrast with this, eggs were observed in 44 of 46 female *S. vulgaris*, 21 of 22 female *S. edentatus*, and one of one female *S. equinus* recovered from the control-2 mare. Similar examination of mature small strongyle females revealed presence of eggs *in utero* in only four (1.8%) of 223, and 22 (7.6%) of 288 from the 12-year-old and seven-year-old mares, respectively. Observation of the small strongyle females from the control-1 and control-2 mares resulted in finding eggs *in utero* in 442 (61.7%) of 792, and 204 (89.9%) of 227, respectively. An additional striking contrast between the female strongyles from the two groups of mares was noted in the relative number of eggs when eggs were observed. Female strongyles from the phenothiazine-treated mares characteristically had few eggs, whereas, those from the control mares generally had numerous eggs *in utero*.

TABLE 2. Strongyles Recovered from Phenothiazine-Treated (Low-Level) Mares and Untreated Control Mares.

Organ	Parasite	Animal			
		12-Yr. Mare	7-Yr. Mare	Control -1	Control -2
Cecum	*S. vulgaris*	0	444	0	102
	S. edentatus	0	0	0	2
	S. equinus	0	0	0	9
	Small strongyles	100	400	3,250	100
Ventral Colon	*S. vulgaris*	22	61	0	0
	S. edentatus	0	60	0	27
	Small strongyles	5,350	7,725	45,700	30,900
Dorsal Colon	*S. vulgaris*	0	22	0	0
	S. edentatus	0	3	0	0
	S. equinus	0	2	0	0
	Small strongyles	1,650	1,050	16,800	150
Totals	*S. vulgaris*	22	527	0	102
	S. edentatus	0	63	0	29
	S. equinus	0	2	0	9
	Small strongyles	7,100	9,175	65,750	31,150
Aneurysm (anterior mesenteric artery)					
	Immature *S. vulgaris*	16	27	0	5

Hematological Observations

No untoward trend was detected in the blood cellular elements of the animals during the fourth year of monthly examinations. Observations are summarized (table 3) by presentation of the means of the various determinations for each mare during the year. These averages compared favorably with those made during the third year. Statistical analysis of the standard error of the differences between means for the two years, revealed that only the erythrocyte count for the six-year-old mare and the mean corpuscular hemoglobin concentration determinations on the eight-year-old and six-year-old mares were significant at the 5% level. The former difference was a decrease while the latter differences represented a decrease for the eight-year-old mare and an increase for the six-year-old mare. Although the differential leucocyte determinations are not included in table 3, the differences in means for each cell type between the third and fourth years were also analyzed statistically. No significant differences were found at the 5% level. For this comparison, the absolute number of a given cell type per unit volume of blood, rather than the differential percentage, was used.



AP-101. This ten-year-old grade mare received 4 gm. of phenothiazine daily for two years. Also pictured is her 1950 foal. No harmful effects of the continuous therapy have at any time been observed on either mare or foal.

General Health

In all discernible respects, the four animals remained normal, healthy subjects throughout the fourth year of continuous phenothiazine administration. Each was successfully bred in the spring of 1951. The six-year-old mare foaled normally during this period of observa-

tion, while pregnancies in the other three mares were terminated when near full-term by experimental virus abortion inoculations.

Gross and Microscopic Pathology

The postmortem examinations of the seven-year-old and 12-year-old mares produced no evidence of gross lesions, ascribable to the drug, in any of the organs examined. Aneurysms involving the anterior mesenteric arteries of these mares were small. Microscopic examinations* of liver, kidney, spleen, lung, and heart sections from these animals also failed to reveal any evidence of tissue injury from the low-level phenothiazine administration.

Discussion

The consistently negative, or low, strongyle egg counts on the monthly fecal examinations through the fourth year of daily phenothiazine administration indicated continued control of the strongyles. These examinations presented no evidence of encountering or developing drug resistant species or strains of strongyles.

In view of the extended interval in which the fecal examinations were negative or of relatively low order for strongyle eggs, the number of worms recovered from the treated mares, postmortem, was surprisingly high, particularly from the seven-year-old mare. Accounting for this paradox points up the efficient sterilizing action of phenothiazine on the mature strongyles in the overall activity of this drug against these parasites. Microscopic examination of both large and small strongyle females tended to confirm this action since developing eggs *in utero* were not detected in the former and in only a small percentage of the latter. Possible action against the reproductive activity of the male strongyles was not excluded.

Inhibitory action on egg production of the strongyles in the horse by low-level phenothiazine administration was reported earlier by Gibson,[1] through observations on the return of the number of eggs in the feces to pre-treatment levels following cessation of therapy and under conditions which tended to preclude reinfection as a factor. Additional evidence pointing to the activity against the reproductive function of these parasites is evident in the passing of infertile strongyle eggs by horses on low-level phenothiazine treatment, as pointed out by Todd, *et al.*[4].

Further consideration of interest in the recovery of relatively large numbers of strongyles from the mares that had received low-level phenothiazine treatment is the relative ineffectiveness of this type of therapy in removing the mature strongyles from the intestinal tract. Under the conditions of this study, reinfection of the mares under treatment was not precluded. Such would be required for a critical evaluation of this phase of activity; however, observations do suggest that, at best, activity of this type of therapy in removing the strongyles is incomplete and slow. In comparison with the control animals, both of the mares that had been on low-level phenothiazine treatment were found to be harboring less small strongyles. However, the number of large strongyles recovered from one of the treated mares was well in excess of the number found in either of the control animals, while the number of large strongyles in the remaining treated mare was intermediate between that found in the control animals.

In the presence of the foregoing, observations further suggest that this type of therapy is only partial, at least in the possible activity of preventing the development of mature strongyles from ingested infective larvae. For this consideration it must be assumed that recovered worms were not harbored before treatment was started, and carried through the four years of the study. This assumption appears reasonable although there is no evidence that strongyles do not survive such an extended period. Evidence indicating that a part of strongyle infections were caused by relatively

*The authors are indebted to Dr. E. R. Doll for collaboration in the preparation and examination of tissue sections.

TABLE 3. Averages of the Monthly Blood Examinations During the Fourth Year of Daily Phenothiazine Administration (2 gm.).

Horse	Erythrocytes (10^6/cu. mm.)	Hemoglobin (gm./100 ml.)	Packed Volume of Erythrocytes (%)	Mean Corpuscular Volume (Cubic Microns)	Mean Corpuscular Hemoglobin Concentration (%)	Leukocytes (10^3/cu. mm.)
8-Year-Old Mare	8.65	12.7	37.1	43.3	29.7	10.01
6-Year-Old Mare	8.70	12.8	37.4	43.3	34.1	9.94
7-Year-Old Mare	8.70	12.8	38.7	44.6	33.1	8.94
12-Year-Old Mare	9.21	13.5	40.7	44.7	33.2	11.21

young individuals was noted in the ratio of fourth-stage small strongyle larvae to mature forms found in treated mares as compared with that obtaining in control animals. As an index of transmission at the time the postmortem examinations were made, the ratio of immature forms was essentially the same in one, and a threefold increase in the remaining treated mares, as compared with the percentage of immature worms in the control mares. A consistently higher ratio of immature forms in the treated mares would have implied an inhibitory effect on the development of the small strongyles.

The number of bloodworms recovered from the aneurysms of the treated mares gave further indication of apparent failure of low-level phenothiazine administration to prevent development of ingested strongyle larvae. The average (21.5) for the two animals approached the average of 28.9 previously reported[3] for horses over two years of age, and not on low-level phenothiazine treatment, and is an increase over the 3.7 and 0.75 recovered from the four animals examined at the close of the first and second years,[4,5] respectively, of the study on this group of horses. This increase may be within the range of individual variation or a reflection of variable exposures preceding the observations, and does not necessarily indicate presence of drug resistance on the part of the parasites, or appearance of a shortcoming of the system of treatment.

Observations in this report are not regarded as discrediting the effectiveness of low-level phenothiazine administration in the control of strongyles in the horse, but rather as clarifying to some extent the means in which this system of treatment manifests its activity against these forms. Under the conditions of the test, treated animals were in contact more or less constantly, both in the stable and on pasture, with an equal or greater number of horses on which no anthelmintic measures were employed. Thus, environmental contamination and exposure of treated animals to infective larvae was maintained. These conditions would not be duplicated in the field use of low-level phenothiazine therapy in horses where all animals were either under treatment, or contact of treated with untreated animals was prevented. Here, activities of sterilizing the mature strongyles and preventing development of infective larvae[1] in feces would be manifested in effecting control of these parasites. The remaining possible activities of removing mature strongyles and preventing development of ingested larvae, although desirable additions, would not be essential to control of these worms.

Of interest equal to the parasitological observations, was tolerance of animals to the daily administration of small doses of phenothiazine over such an extended period of time. In this test, the drug was fed daily over the four-year period, whereas in field use of this type of therapy the drug is generally fed only the first 21 days of each month. Without intermittent rest periods, the amount of phenothiazine received by the test animals was well in excess of that administered in the field. No untoward effects on the general health and reproduction of any of the animals was detected. There was no evidence of anemia or other tissue damage being produced by the prolonged drug administration.

Summary

In a group of four horses that had been on low-level phenothiazine therapy during the preceding three years, 2 gm. daily doses were continued through the fourth year. No manifestation of toxicity was discovered in any of the animals. Monthly fecal examination for strongyle eggs showed consistently negative or low order counts. Postmortem examinations of two of the mares revealed presence of relatively large numbers of both large and small strongyles in the large intestine. This apparent discrepancy emphasized effectiveness of the action in inhibiting egg production by strongyles. Presence of the strongyles further suggested relative ineffectiveness of this type of therapy in the possible actions of removing strongyles from the intestinal tract and of preventing the development of mature strongyles from ingested infective larvae.

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Terramycin Injections Control Chronic Respiratory Disease In Two Pullet Flocks

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DURING the past few years, the poultry industry has become increasingly burdened with a condition known as chronic respiratory disease, or air sac infection. The term "air sac infection," however, is nonspecific and may be used to refer to any disease, such as Newcastle disease, bronchitis, brooder pneumonia, etc., which is associated with a morbid condition of air sacs. In the light of most recent information, the term "chronic respiratory disease" (CRD) probably should be reserved for a lingering respiratory affliction of chickens, first described in 1943 by Delaplane and Stuart,[1] and thought to be identical with infectious sinusitis in turkeys. The disease is associated with the presence of coccobacillary bodies which are described as probably classifying in the pleuropneumonia group by Markham and Wong[2]. Possibility of egg transmission is suggested by Van Roekel, *et al.*[3].

In spite of much research, no means have been made available to the poultry industry for control of this serious disease. Wong[4] has shown that of commercially available antibiotics, only terramycin, streptomycin, aureomycin, and chloromycetin® exert significant activity against the etiological agent in egg embryo cultures. The activity of terramycin was of a high order—from four to six times as effective as streptomycin and approximately eight times as effective as aureomycin. The activity of chloromycetin was of a low order. One would anticipate in consequence that antibiotics, particularly terramycin, should find useful application in control of chronic respiratory disease and infectious sinusitis. Streptomycin, as is well known, has been used parenterally in successful treatment of sinusitis infection in turkeys. Oral administration of antibiotics, however, has in general proved disappointing for control of CRD or infectious sinusitis. That activity, however, is exerted at very high intakes as indicated in reports by Grumbles and Boney,[5] and Van Roekel, *et al.* Former workers observed very high oral intakes of chloromycetin or terramycin to exert therapeutic benefit against infectious sinusitis in turkeys, while Van Roekel *et al.* reported that daily administration of 200 mg. of terramycin hydrochloride per day altered the course of CRD in experimentally infected birds.

Since oral administration of antibiotics has not proved entirely satisfactory, attention was directed to studies on parenteral administration of terramycin. Obviously, for this purpose, a retention form of vehicle is required, and studies were made of terramycin-oil suspensions. Following investigation of several potential dosage forms, a suspension consisting of 2.5% terramycin hydrochloride (25 mg./cc.) in mineral oil was selected for field evaluation. The following case reports detail observations on subcutaneous administration of this new preparation (terramycin-mineral oil suspension—TMOS) in the therapy and prophylaxis of a respiratory disease occurring in two pullet flocks, the disease being indistinguishable symptomatically from so-called CRD.

Case 1. At about the sixth week, a condition indistinguishable from CRD appeared in a group of about 3,300 meat-type, Barred Rock replacement pullets. Severe chronic coughing continued in the birds for weeks, accompanied by abnormal death losses. At the 11th week, or five weeks after onset of symptoms, 150 of the more severely affected birds were segregated and treated subcutaneously with 4 cc. of TMOS. At the end of one week, essentially all evidences of respiratory distress had disappeared from this lot whereas the much larger untreated group continued to show marked evidences of respiratory disease. Three weeks later, or 14 weeks after onset of symptoms, the affected group was divided into three lots and treated as follows:

Lot	Birds	TMOS subcutaneously cc.	Results at 7 days
1	1200	2	Remission of respiratory symptoms
2	1800	4	Remission of respiratory symptoms
3	300	controls	Continuing evidence of respiratory distress

Immediately upon conclusion of the above trial, all controls and birds otherwise un-

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®Parke, Davis & Co., Detroit, Mich.

treated were injected with the oil suspension, and the entire group transported to a second farm where they were housed for laying. Subsequent history was normal and uneventful. Birds came into satisfactory production, attaining maximum weekly lay of more than 60%. This record is regarded as excellent for the type and breed. No relapse of respiratory

Fig. 1. Treatment of chickens for chronic respiratory disease. Birds are injected with terramycin-oil suspension subcutaneously in the neck immediately back of the head, using a Cornwall-type automatic syringe. A one-inch, 14-gauge needle is recommended.

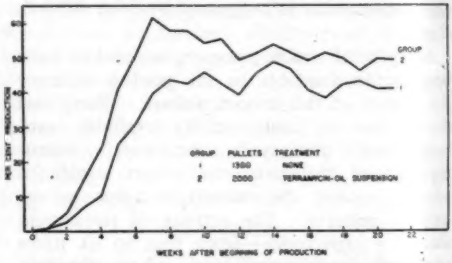
disease had occurred in these pullets at seven months post-treatment, the latest observation date. By way of contrast, a previous group of 1,300 untreated pullets of the same type and breed, reared under the same conditions and suffering from attack of a similar disease, attained a maximum weekly production of only 48%. Production curves for the two groups over a period of 22 weeks are shown in graph 1. Superiority of the treated birds over those untreated is self evident. (Only 2,000 pullets from the 3,300 in the treated group are included, since production in the remaining 1,300 can not be properly interpreted due to bird mixing.)

Case 2. Case 2 represents a White Leghorn breeder-hatchery farm, birds in the breeder units being maintained on two separate establishments but all originating from a common source. Pullets involved in these observations were secured from three hatches which will be termed respectively "January", "April", and "May" birds. Farms will be designated as "farm A" and "farm B."

The January group of near 4,700 pullets was hatched from a common source and subsequently divided between farms A and B. Rearing was without special incident, there being the usual outbreaks of such common diseases as coccidiosis and blackhead. Losses from respiratory disease during brooding and ranging periods were negligible. Pullets were housed for laying in July, there being approximately 1,500 birds housed on farm A and 3,200 on farm B. At the time of housing in three groups, all 3,200 pullets on farm B were injected subcutaneously with 2 cc. TMOS. These birds subsequently attained a peak of 85% house production. Up to six months after the terramycin injections, there had been no evidence whatever of CRD in these bird groups. Culling and mortality were low, most of the losses resulting from prolapses in consequence of the high production.

The situation with respect to farm A was quite different. The January birds in this case were housed in five groups of 300 each. They were not treated with terramycin. Approximately three weeks after housing, all five groups developed symptoms indistinguishable from CRD, accompanied by declines in production. All birds in the five groups were, therefore, treated with 2 cc. of the antibiotic suspended in oil, the treatments being from ten to 15 days after the onset of respiratory symptoms. Production curves for the groups are shown in graphs 2A to 2E.

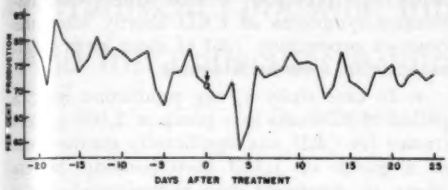
All five of these groups had been housed, and had attained peak productions in excess



Graph 1. (Groups 1 and 2.) Terramycin injections in control of chronic respiratory disease as reflected by egg production in groups of meat-type, Barred Rock pullets. Both groups were affected during the brooding period with a disease indistinguishable from chronic respiratory disease. The birds in group 1 remained untreated whereas those in group 2 were treated with terramycin at the 14th week.

of 70%. Normally, one expects gradual, protracted decline in rate of egg lay from such groups after peak production is reached. Graphs 2A to 2E indicate that such decline was occurring in all five groups, but was more rapid than should occur normally, and was associated with appearance in all groups of a chronic cough or "snick," suggestive of CRD. Study of the curves reveals unmistakably that the downward production trend in each case was interrupted following administration of

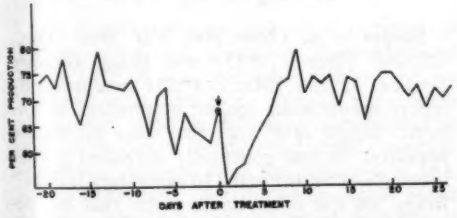
TMOS, and that this reversal occurred within one week in all five groups after terramycin treatments. Significance of this relationship is further emphasized by the fact that treatments of respective groups were staggered and did



Graph 2A. (Group 3.) Terramycin injections in control of chronic respiratory disease as reflected by egg production in a group of 300 recently-housed, White Leghorn pullets. Each bird injected with 50 mg. of terramycin hydrochloride suspended in mineral oil.

not occur simultaneously. The record of group 4 (graph 2B) is especially significant, and leaves little room for doubt that such treatment was associated with production response. Production trends in groups 3, 5, and 6, before and after treatment, differ only in degree from that of group 4. An undoubted production stimulus was associated with the treatment of group 7 (graph 2E), but the general rapid fall in rate of lay in this group suggests possibly that adverse factors other than CRD were at work.

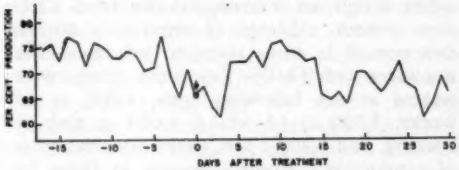
It should be pointed out, in connection with the above, that treatments were correspondingly associated with disappearance of respiratory symptoms, this occurring within ten days after treatment in each group. After six months, there had been no relapse of the disease condition in any of the groups.



Graph 2B. (Group 4.) Terramycin injections in control of chronic respiratory disease as reflected by egg production in a group of 300 recently-housed, White Leghorn pullets. Each bird injected with 50 mg. of terramycin hydrochloride suspended in mineral oil.

The April hatch of birds was composed of approximately 1,000 pullets. They were brooded and ranged as a unit until divided between the two farms at five months of age. There had been no history of respiratory disease in these birds. At the time of division, the birds were blood tested and vaccinated wing web for Newcastle disease. Seven to ten days after vaccination, persisting coughing developed which steadily worsened, the condition having every indication of CRD. Both groups on farms A and B were subsequently treated with 2 cc. TMOS. Symptoms of respiratory distress subsided within a week to ten days, and subsequent production of the groups on both farms is regarded as satisfactory.

The May hatch was comprised likewise of about 1,000 pullets. These chicks developed persisting respiratory symptoms at four weeks. The condition worsened, and was severe at the sixth week. At this time, all birds were treated with 2 cc. TMOS accompanied as usual by a remission of respiratory symptoms by the tenth day. These birds subsequently developed without incident of note; mortality during the growing period was very low, and no birds were discarded as culls at housing. Birds were divided equally between the two farms and achieved normal production without any indication whatever of respiratory troubles. The



Graph 2C. (Group 5.) Terramycin injections in control of chronic respiratory disease as reflected by egg production in a group of 300 recently-housed, White Leghorn pullets. Each bird injected with 50 mg. of terramycin hydrochloride suspended in mineral oil.

May birds on farm A reached a sustained production of more than 80%.

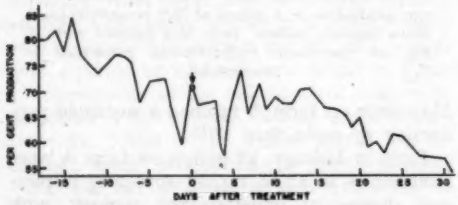
Early in January, all pullets on farm A were attacked by an acute, rapidly-spreading respiratory disease of undetermined etiology, with recovery from respiratory symptoms taking place in from one to two weeks. Near complete restoration of former egg production occurred in the May birds. Restoration was somewhat less complete in the case of the April birds, and was only partial in older January groups. This pattern is not regarded as inconsistent. Outbreaks of acute respiratory disease are commonly regarded as stimulative to a condition of dormant CRD. Since there was no aftermath of consequence to the above acute disease outbreak (other than predictable production loss in older birds), one can assume that the etiological agent of CRD was not present in these bird groups.

Graph 2D. (Group 6.) Terramycin injections in control of chronic respiratory disease as reflected by egg production in a group of 300 recently-housed, White Leghorn pullets. Each bird injected with 50 mg. of terramycin hydrochloride suspended in mineral oil.

Conclusions

In two case studies involving more than 11,000 pullets, a product consisting of a terramycin suspension in mineral oil (TMOS) was administered subcutaneously for both prophylaxis and therapy of a disease condition indistinguishable symptomatically from so-called chronic respiratory disease (CRD). The following results were secured:

1. In pullet groups totaling 6,800 birds, where symptoms indistinguishable from CRD were present, evidence of respiratory distress disappeared in from seven to ten days after treatment with TMOS. Respective groups were treated at the following ages: 1,000 at six weeks; 3,300 at 14 weeks; 1,000 at time of housing; and 1,500 a few weeks after the onset of production. Control groups, in those instances where controls were possible, continued to show evidences of the disease after symptoms had cleared in treated birds.



Graph 2E. (Group 7.) Terramycin injections in control of chronic respiratory disease as reflected by egg production in a group of 300 recently-housed, White Leghorn pullets. Each bird injected with 50 mg. of terramycin hydrochloride suspended in mineral oil.

2. In one instance where symptoms of CRD appeared after onset of production (the 1,500 birds referred to in 1 above), declining rate of egg lay associated with respiratory symptoms was reversed within seven days after treatment with TMOS. Reversal occurred in each of five bird groups.

3. In case study 2, no bird group treated prophylactically or therapeutically with terramycin prior to onset of production subsequently developed manifestations of CRD. On the other hand, all of five bird groups (2, above) not previously treated with TMOS developed symptoms of CRD shortly after the onset of production. All of these birds originated from a common source.

4. In case study 1, egg production over a period of 22 weeks in a group of 2,000 pullets treated for CRD was significantly greater than in a group of 1,300 corresponding pullets where no treatment was administered for a similar condition of disease.

5. There had been no occurrences or relapses of a condition suggestive of CRD in any of 13 pullet groups totaling 10,000 birds up to at least six months after either therapeutic or prophylactic treatments with terramycin-mineral oil suspension.

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Sanger *et al.* (*Jour. Am. Vet. Med. Assn.*, 122:207 [Mar.], 1953) and Bragg (*Poultry Science*, 32:294 [Mar.], 1953) independently report spontaneous tongue deformities in turkeys. Sanger *et al.* state that since the disease appeared "in four genetically unrelated groups, it could not be attributed to hereditary factors." Bragg, on the other hand, states that the deformity "may be explained by a fairly recessive genetic factor or genetic difference in the nutritional requirements."

Sanger *et al.* further state that since the lesions can be produced in chicks by feeding deficient rations, "it is postulated that the turkey disease may also be caused by a nutritional deficiency." Bragg does not concur with this view and states that "it appears that the deformity is not caused by a deficiency . . . in the poults' diet."

Milk, Blood, And Urine Concentrations Of Terramycin Following Intravenous, Intramammary, And Intramuscular Administration*

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OF the recently developed antibiotics, terramycin† has received much attention because of its chemotherapeutic possibilities. It possesses a wide spectrum of antibacterial activity and is an effective therapeutic agent for some of the larger viruses. Investigations indicate this antibiotic to possess a low degree of toxicity when administered to animals[1,2,3].

The clinical application of terramycin in veterinary therapy has been described by a number of workers[4,5,6]. However, the majority of clinical studies has been made on small animals.

To utilize successfully any therapeutic agent, knowledge of rates and routes of elimination of the specific drug when administered by various recognized routes is desirable. The purpose of the work herein reported was to determine rates and routes of elimination of terramycin when administered intravenously, intramammarly, and intramuscularly in dairy cows. Particular emphasis has been placed on the possibility of this drug being employed in mastitis therapy.

Experimental Procedure

All experimental animals were lactating at varying levels and no clinical mastitis existed at the time of drug administration.

Blood, milk, and urine samples were taken at various intervals following administration and immediately refrigerated until assayed. Blood was obtained from the jugular vein and, upon coagulation, centrifuged to obtain blood serum. Urine was obtained by artificial stimulation of micturating reflexes. All samples were assayed within 12 hours after collection.

The method of assay employed was described for aureomycin by Schipper and Petersen[7] with some modifications. These included employment of a dried non-fat milk solids preparation to replace skim milk used in the aureomycin assay. This medium was prepared by adding 10 gm. of non-fat milk solids to 100 ml. of distilled water, dissolving and autoclaving for 12 minutes. This provided a medium that was of more constant makeup. The test organism employed was *Streptococcus lactis*. This organism was employed because of its methylene blue-reducing qualities, sensitivity to terramycin, and because of absence of the immune reaction in milk and bovine serum that sometimes occurred with the organism employed in aureomycin assay. Milk samples collected after intramammary infusion were collected previous to (fore milk) and immediately after (strippings) the routine milking procedure. Leucocyte counts and the Whiteside tests were made on all samples obtained to determine whether the drug was irritating.

All readings (tables 1 and 2) indicated at least the quantity of drug designated to be present, but not more than double the quantity designated. These results were obtained because two-fold serological dilutions were employed on all samples.

RESULTS

Intravenous Administration

Intravenous Administration of 5 mg. per lb. of body weight. Intravenous administrations of 5 mg. of terramycin per lb. of body weight via jugular vein presented blood levels of varying degrees in each animal treated (table 1). A high level of 5 micrograms per ml. and a low of 1.2 micrograms were observed one hour after administration. Terramycin was detected in the blood up to 24 hours after administration with therapeutic levels being maintained for two to four hours.

Therapeutic levels in milk were usually reached at one to two hours after administration and were maintained for 12 to 24 hours. A precipitous drop in drug concentration in milk was usually observed following the first

*Scientific Journal Series Paper no. 2949, Minnesota Agricultural Experiment Station.

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†Terramycin supplied by Dr. E. H. Peterson, Chas. Pfizer and Co., Inc., Brooklyn, N. Y.

complete routine milking 12 hours after administration.

High levels of terramycin were detected in the urine within one hour after administration and remained so for at least 12 hours. Therapeutic levels of terramycin were still present in urine 24 hours after administration. No diuresis could be observed following intravenous administration. This was further corroborated by determining the specific gravity of urine samples.

Intravenous administration of 2 gm. of terramycin per cow. In general, results of intravenous administration of 2 gm. of terramycin per cow were comparable to 5 mg. per lb. live weight. No significant differences could be observed in concentration of drug or interval of persistence in urine.

It will be noted, table 1, that variations in concentration existed among all animals for all materials assayed when either dosage was employed.

Intramammary Infusion

Terramycin was administered intramammarly in two vehicles: one an ointment base, and the other sterile distilled water. Sterile water was employed because of generally more successful therapy with water as a diluent.

Ointment Vehicle. As table 2 indicates, the highest concentration of terramycin was detected in fore milk removed 12 hours after administration. A precipitous drop in drug concentration was usually noted in strippings following the first complete milking. Therapeutic levels were detected in some instances up to and including the 72 hour samples and great variations in concentration were noted between cows as well as between quarter samples of any one cow.

Sterile Distilled Water Vehicle. When sterile distilled water (50 ml.) was employed as diluent, generally lower concentration of terramycin was detected in fore milk of the first routine milking as compared with drug concentration at the same interval when ointment was employed as a vehicle (table 2). Usually, higher drug concentration was observed in fore milk as compared with strippings of the same post-administration interval. Large variations in drug concentration between experimental animals and quarter samples of any one animal will be noted in table 2. Therapeutic levels of terramycin existed in the milk up to 48 to 60 hours after administration. Generally, lower drug concentration was observed at all intervals of sampling when sterile distilled water was employed as a diluent rather than the oint-

TABLE 1. Milk, Blood, and Urine Levels After Intravenous Administration of Terramycin at Various Dosages

Dosage	Cow No.	Material assayed	Post-administration time in hours (micrograms per milliliter)							
			1	2	4	8	12*	24*	36*	48*
5 mg. per lb.	9	M	1.2	1.2	1.2	2.5	2.5	1.2	0	—
	T11	B	5.0	2.5	1.2	0.6	1.2	0.3	0	—
		U	—	499.2	125.0	125.0	62.8	31.2	—	—
		M	2.5	1.2	2.5	2.5	1.2	0.6	0	—
	T12	B	1.2	0.6	0.3	0.3	0.3	0	0	—
		U	499.2	499.2	499.2	249.6	125.0	31.2	—	—
		M	2.5	2.5	4.9	9.9	4.9	1.3	0.3	—
	T41	B	0.3	0.3	0.3	0.3	0	0	0	—
		U	—	499.2	249.6	249.6	124.8	31.2	—	—
		M	0.3	0.3	2.4	4.9	4.9	2.4	0.3	—
	866	B	2.4	1.2	0.3	0.3	0.3	0	0	—
		U	—	998.4	—	499.2	249.6	62.4	—	—
		M	0.6	0.6	0.6	1.2	1.2	0.3	0	—
2 gm. per cow	807	B	2.4	0.6	0.6	0.3	0.6	0	—	—
	(915 lb.)	U	4975.0	4975.0	249.0	124.8	124.8	0.3	0	—
		M	0	0	1.2	2.4	1.2	0	0	—
	808	B	0.6	2.4	0.3	0.3	0.3	0	—	—
	(1140 lb.)	U	499.2	325.0	1225.0	499.2	998.4	249.6	9.9	2.4
		M	0.6	0.6	1.2	1.2	1.2	0.6	0	—
	868	B	4.9	4.9	2.4	2.4	0.6	0	—	—
	(1130 lb.)	U	—	19.9	2475.0	998.4	499.2	124.6	9.9	—
		M	—	0.6	0.6	0.6	0.6	0	0	—
	923	B	1.2	1.2	2.4	2.4	0	0	—	—
	(1260 lb.)	U	4975.0	—	998.4	998.4	499.2	499.2	124.8	4.9

M, milk; B, blood serum; U, urine; —, no sample; *, composite milk sample of complete routine milking.

ment vehicle. In all probability, more terramycin was absorbed through mammary parenchyma into the systemic circulation when the water vehicle was employed.

Intramuscular Terramycin

Intramuscular administration of terramycin (3 gm. per cow) resulted in elimination of a high concentration of this drug in urine. Terramycin was observed in urine within one hour after administration and usually reached maximum concentration after eight hours. Maximum concentration of approximately 500 micrograms per milliliter was observed. Concentration of 19.9 micrograms per ml. was observed 48 hours after administration.

A maximum of 0.3 micrograms per ml. was observed in blood at two- and four-hour intervals. No terramycin could be detected in blood until two hours after administration. No terramycin was detected in milk at any time up to 24 hours post-administration time. Irritation was not detectable at any time at the site of administration.

Discussion

The material presented above provides information on the general trend of routes and rates of elimination of terramycin from mature cattle after administration of various dosages via recognized routes.

Intravenous administration results in therapeutic levels in the blood being maintained for approximately eight hours after administration. Milk levels of therapeutic concentrations were maintained for at least 12 hours with precipitous drop in concentration after the first complete milking. Urine concentrations were very

TABLE 2. Terramycin Levels in Milk after Intramammary Infusion (400 mg. per quarter)

Vehicle employed	Cow No.	Quarter infused		Post-administration time in hours (micrograms per milliliter of milk)						
				12	24	36	48	60	72	84
Ointment 7.1 gm. per quarter	230 (22 lb.)	1	F	124.8	124.8	19.9	2.5	2.5	2.5	—
			S	1996.8	62.4	9.9	2.5	2.5	0.7	0
		2	F	249.6	124.8	29.9	4.9	4.9	2.5	—
			S	62.4	62.4	4.9	2.5	2.5	1.2	0
		3	F	62.4	62.4	29.9	9.9	2.5	2.5	—
			S	124.8	62.4	19.9	2.5	2.5	1.2	0
		4	F	19.9*	9.9	2.5	2.5	0.6	1.2	—
			S	124.8	19.9	4.9	1.2	1.2	0.6	0
	924 (16 lb.)	1	F	124.8	19.9	9.9	1.2	1.2	0	—
			S	19.9	9.9	9.9	0.6	1.2	0	0
		2	F	124.8	9.9	4.9	1.2	1.2	0	—
			S	19.9	4.9	2.5	0	0	0	0
		3	F	124.8	19.9	9.9	1.2	1.2	0	—
			S	19.9	9.9	4.9	0	0	0	0
Sterile distilled water 50 cc. per quarter	T34 (22 lb.)	1	F	124.8	9.9	1.2	0.6	0.3	—	—
			S	9.9	4.9	1.2	0.3	—	—	—
		2	F	62.4	19.9	1.2	0.3	0	—	—
			S	19.9	4.9	0.6	0	—	—	—
		3	F	31.2	19.9	1.2	0.3	0	—	—
			S	19.9	4.9	1.2	0.3	—	—	—
		4	F	19.9	9.9	1.2	0.3	0	—	—
			S	19.9	2.4	1.2	0.3	—	—	—
	T59 (19 lb.)	1	F	31.2	9.9	4.9	1.2	0.6	—	—
			S	9.9	4.9	1.2	1.2	—	—	—
		2	F	62.4	19.9	2.5	0.6	0.3	—	—
			S	19.9	4.9	0.6	0.6	—	—	—
		3	F	31.2	9.9	4.9	0.6	0.6	—	—
			S	9.9	4.9	1.2	0.6	—	—	—
		4	F	31.2	9.9	4.9	0.6	0.6	—	—
			S	19.9	4.9	1.2	0.6	—	—	—
	700 (18 lb.)	1	F	499.2	19.9	4.9	4.9	4.9	0	—
			S	124.8	9.9	9.9	4.9	4.9	—	—
		2	F	1996.0	19.9	2.5	2.9	2.9	0	—
			S	249.6	4.9	4.9	2.9	1.2	—	—
		3	F	998.4	19.9	4.9	4.9	4.9	0	—
			S	124.8	4.9	4.9	4.9	0	—	—
		4	F	998.4	19.9	4.9	2.5	2.5	0	—
			S	249.6	4.9	2.5	2.5	2.5	—	—

F, fore milk; S, strippings; —, no sample; figures in parentheses are average daily milk production.

high for at least 24 hours after administration and in some instances were maintained for 48 hours.

From the above results, it is evident that intravenous administration of terramycin would be beneficial in mastitis therapy in many animals, particularly as an adjuvant to intramammary therapy. On the basis of high concentration of drug eliminated by the urinary system, terramycin would be definitely indicated in infections of the urinary system. Results of intramammary infusion of terramycin present a picture of lower drug concentration in milk when administered in water, as compared with the ointment vehicle. Presumably, larger quantities of terramycin penetrate the mammary parenchyma and enter the systemic circulation when sterile water is employed as a diluent. Upon intramammary administration, rather wide variations in drug concentrations were detected for different animals and individual quarters for the same animal. Some of these differences may be accounted for because of variation in milk production and udder size. Precipitous drop in drug concentration was detected with each complete milking, particularly with the ointment preparation. Intramuscular administration of terramycin in sterile distilled water yielded results indicating a high concentration of drug eliminated in urine. Terramycin was detected in the blood in such trials, but not in milk. The possibilities of intramuscular administration of terramycin with various vehicles and as an adjuvant to other routes of therapy remain to be investigated.

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First World Congress on Fertility and Sterility

Sponsored by the American Society for the Study of Sterility and the International Fertility Association, the First World Congress on Fertility and Sterility was held in New York on May 25-31, 1953. The Congress consisted of 25 sessions at which 220 papers were read. Attendance totaled 1,800, representing 50 countries.

The Veterinary Section of this Congress dealt with some problems of reproduction in animals. Dr. M. G. Fincher, New York State Veterinary College, Cornell University, Ithaca, served as honorary chairman. Proceedings of the entire conference may be obtained by addressing Dr. Abner I. Weisman, 1160 Fifth Avenue, New York 29, N. Y. The price is $21. No separate printing of the proceedings of the veterinary sessions is available.

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Penny-a-Pig for Research

The executive secretary of the National Swine Health Research Foundation, Mr. Ralph Waltz, Hagerstown, Ind., announces that he has received the first check for penny-a-pig check-off from an Indianapolis commission firm. According to *Breeder's Gazette* for July 1953, Secretary Waltz has been having difficulty getting this check-off system started. Shippers are requested to instruct commission firms to deduct a penny per head for use by the Foundation.

Success of the program will depend on ability to integrate this disease research effort with that presently in progress under other qualified leadership and direction.

▾ ▾ ▾

While we express grave concern over vesicular exanthema, and bewail the great bogey of foot-and-mouth disease that hangs over our heads, there is a disease (atrophic rhinitis) that is cutting the swine industry off at its foundation. — *A. H. Quin, D.V.M., Kansas City, Mo.*

▾ ▾ ▾

Occurrence of ornithosis in man has been reliably traced, not only to psittacine birds, but also to such domestic birds as chicken, pigeon, duck, turkey, and pheasant. The recent possible implication of ornithosis-like agents being responsible for air sac infection is of great interest, both from the standpoint of etiology and of veterinary public health.— *E. L. Jungberr, D.V.M., Storrs, Conn.*

Observations Concerning Hazard To Animals From Use Of TEPP-Lindane Bait For Fly Control

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THE first report of resistant houseflies (*Musca domestica L.*) was from Italy in 1946. This was two years after initial use of DDT in that country[1]. In 1947, resistance was reported in New York[2] and, since that time, insecticide-resistant houseflies have been observed all over the world. It has been found that, after resistance is once established to one insecticide, the housefly is resistant in varying degrees to others[3]. Strains of houseflies have become resistant to all commonly used insecticides, which include DDT, DDD, methoxychlor, toxaphene, lindane, heptachlor, pyrethrins, chlordane, parathion, thanite,®[1] rotenone, and dieldrin[4,5]. The gravity of the situation was emphasized when it was found that high resistance was unchanged after 30 generations with no exposure to insecticides[6].

Because of resistance to commonly used insecticides, many compounds and methods have been investigated. A recent method is application of a mixture of lindane and tetraethyl pyrophosphate (TEPP) (ortho H.L. 636) with a sprinkling can to areas frequented by flies[7]. Two and one-half gallons of water are put in an ordinary garden-type sprinkling can and then one-quarter to one-half pint of syrup or molasses is added. A four-ounce bottle of H.L. 363, ortho®[2] fly killer, is emptied into the mixture and stirred. The toxicant is composed of 10.7% lindane, 4.7% TEPP, and suitable emulsifiers and solvents. The end solution contains 0.15% lindane and 0.06% TEPP.

The mixture is sprinkled in the gutters, on walkways, and floors in areas most frequented by flies (fig. 1). Feed, feed containers, and milking utensils should be avoided. In some instances, where straw, lime, or other debris may be on the floor, empty burlap sacks or cotton feed sacks may be placed on the floor and sprinkled with diluted material (fig. 2). The sprinkling-can method has been successfully used to control both resistant and nonresistant flies in dairies, dog kennels, poultry units, and processing plants.

After initial screening of the mixture of lindane and TEPP as an insecticide, toxicity of the ingredients was investigated. The l.d.-50 of TEPP given orally to rats is 1.4 to 2 mg. per kg.[8] and the amount considered dangerous for skin application is 10 mg. per kg. for a single exposure and 5 mg. per kg. for multiple exposures[9]. After a toxic dose, the first symptom observed is an increase in rate of respiration. This is followed by unsteadiness, lack of coordination, muscular twitching, and salivation. Miosis, defecation, urination, and lacrimation usually occur[10]. There are no diagnostic postmortem lesions. TEPP inhibits cholinesterase and stimulates the parasympathomimetic system. Atropine is a specific antidote.

The l.d.-50 of lindane given orally is considered to be 125 mg. per kg., while the amount considered dangerous upon skin application is 50 mg. per kg. for a single exposure and 20 mg. per kg. for multiple exposures[9]. Typical symptoms of lindane poisoning are increased respiration, restlessness, tremors progressing to convulsions, salivation, grinding of teeth, rolling of the eyes, and the final stage is opisthotonos with the limbs paddling. Postmortem changes may include hemorrhages of the gastrointestinal tract, heart, and lungs, swelling and congestion of the kidneys and liver with edema, as well as congestion in the brain and spinal cord. Calcium gluconate may be used as an antidote in conjunction with symptomatic treatment.

Experimental Data

Around many dairies there is a wide variety of animals in addition to the cattle. It is not uncommon to find chickens, ducks, geese, dogs, and cats in dairy barns. Some of these species are susceptible to insecticides and any of them might inadvertently contact the mixture of lindane and TEPP after it is applied to the floor. The separate ingredients, and a mixture, were checked against calves, rabbits, cats, and a dog to determine safety before the product was released for public use.

1. A three-day-old Guernsey bull calf was sprayed on three successive days with 1 gal. of 0.031% TEPP. No toxic symptoms were noted.

®[1]Hercules Powder Co., Wilmington, Del.

®[2]California Spray-Chemical Corp., Richmond, Calif.

2. A three-day-old Jersey bull calf was sprayed on two successive days with 1 gal. of 0.06% TEPP. No toxic symptoms were noted.

3. A three-day-old Jersey bull calf was sprayed with 1 gal. of 0.25% TEPP. In 30 minutes there was salivation, severe dyspnea,

Fig. 1. Application of ortho fly killer for housefly control in dairy barns.

prostration, and body twitching. Death occurred in 50 minutes. The only postmortem lesions were hemorrhages and edema in lungs and petechiae in myocardium.

4. One-half pint of a mixture of 0.3% lindane and 0.06% TEPP was applied on two successive days to a three-day-old Jersey bull calf with no noticeable effect.

5. A single application of three-quarter pint of a mixture of 0.3% lindane and 0.06% TEPP was not toxic to a three-day-old Jersey bull calf.

6. Oral administration of 10 mg. per kg. of TEPP in xylol was toxic in five minutes to a half-grown male albino rabbit. Four minutes after administration pupils were constricted, ear veins dark, and there was extreme salivation. On postmortem examination, the heart was in systole and blood dark; lungs were normal.

7. Oral administration of 5 mg. per kg. of TEPP in xylol was fatal to a half-grown male albino rabbit in ten minutes. The symptoms and postmortem lesions were similar to the case where 10 mg. per kg. were given.

8. A four-year-old Boxer was washed twice in a 0.01% TEPP solution at one-week interval. There were no indications of poisoning at any time.

9. Four half-grown cats were exposed on three successive days, 24 hours a day, on a concrete floor treated daily with a mixture of 0.15% lindane and 0.06% TEPP at the rate of 25 cc. per sq. ft., which was the saturation and runoff point. No symptoms of lindane or TEPP poisoning were observed.

10. Application of a mixture of 10.7% lindane and 4.7% TEPP to a shaved area on a lactating cat, based on the rate of 10 mg. per kg. TEPP, was near the lethal point. Typical symptoms of poisoning were exhibited, which included dyspnea and salivation. Four hours after application, the cat was apparently normal.

In barns, where the mixture was applied for fly control, there were chickens, ducks, and geese. Many of these birds were observed feeding on flies killed by the toxicant. In addition, dogs, cats, and calves were observed walking, sitting, or lying on the treated floor. There were no toxic symptoms observed and no deaths of any animal resulted from use of the mixture.

During field trials of the mixture of lindane and TEPP as a control for houseflies, samples were given to dairymen in many states to be applied under local conditions. Occasionally, applicators would splash some of the material on themselves and, in two instances, the material was applied to floors while applicators were barefooted. This was contrary to explicit instructions to avoid contact with either the concentrated or diluted material; however, there were no observed symptoms of insecticide poisoning.

Fig. 2. House flies killed by application of ortho fly killer on feed sack.

Milk samples were taken from cows in two dairies where the floors were treated with this mixture. There was no trace of lindane in the milk. Analytical methods sensitive to 0.001 p.p.m. were utilized to check milk samples for presence of TEPP. None was detected in milk from cows in barns treated with the mixture.

Summary

Since discovery of insecticide-resistant houseflies, many compounds and methods have been investigated. A recent development is the application of a mixture of lindane and

(*Continued on page 323*)

Epizoology Of Vibriosis And Listeriosis Of Sheep And Cattle*

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LISTERIOSIS and vibriosis are increasing in frequency among sheep flocks and cattle herds in this area. Vibriosis is usually characterized by abortion, and in some outbreaks of listeriosis abortion may be the outstanding symptom. Because of the similarity of epizoology in outbreaks of these two diseases, a study of several infected flocks and herds has been made.

Prier[1] has recently reviewed the literature on vibrionic abortion. It has generally been concluded that abortion is the only symptom of vibriosis; however, Adler and Rasbeck[2] report that temporary sterility is a common symptom following vibrionic abortions of cows.

Abortions due to Listeria infections are probably much less frequent than in vibriosis. Paterson,[3] Poppensiek,[4] and Eveleth and Goldsby[5] have reported abortion as a symptom of listeriosis in sheep. Graham, Hester, and Levine[6] recovered *Listeria monocytogenes* from an aborted bovine fetus.

In an earlier study of the epizoology of listeriosis,[7] we found that, in outbreaks on 44 different farms, there was always history of purchasing sheep within a year previous to appearance of the disease. In 30 of the 44 flocks, histories indicated that sheep were purchased from flocks in which listeriosis had previously been demonstrated.

The literature on listeriosis was reviewed by Graham, Levine, and Morrill[8] in 1943, and more recently by Gray, Stafseth, and Thorp[9].

Diagnosis of listeriosis in this investigation has been based on cultural characteristics, morphology, and ability of the culture to cause conjunctivitis when swabbed into a guinea pig's eye.

Diagnosis of vibriosis has been based on the morphology and motility of the organism from stomach contents of the fetus, and by culturing the same material in the allantoic-amniotic fluid of the chick embryo.

During the course of this study over a seven-year period, data have been collected on herds and flocks where either listeriosis or vibriosis had occurred. In two sheep flocks both diseases have been diagnosed.

The epizoology of these two diseases can be best illustrated with case histories**.

Case Reports

Case 1. A flock of young ewes was shipped into this area in the fall of 1946, and bred to start lambing April 27, 1947. Ewes were all from one source but rams were from several flocks. The ewes started aborting April 5 and by April 25, 125 of 1,100 ewes had aborted. Vibriosis was diagnosed from fetuses submitted for examination. More than half of the flock aborted before the disease had run its course.

These ewes were bred again in the fall of 1947. On March 28, 1948 the owner submitted an aborted fetus. A culture of *Listeria monocytogenes* was isolated. By April 19, 60 ewes had aborted. Listeria cultures were obtained from two more fetuses. The flock was vaccinated with an experimental Listeria bacterin and only four ewes aborted thereafter.

This flock has not had undue losses from either of these diseases in the four years following the listeriosis outbreak.

Case 2. This was an assembled flock of western ewes. Circling was observed in January 1948. Losses ran as high as six ewes per day. Listeria cultures were obtained from the brains of several animals submitted. The flock was disposed of in the spring of 1948. A few lambs were fed during 1949 and 1950; no sheep were kept on these premises during the ensuing year. A test flock of 11 was introduced in April 1951; unfortunately a stray came to the place and mixed with the flock. The stray died and no examination was made. A short time later, one of the 11 ewes died and a diagnosis of listeriosis was made. In the

*This is a progress report on R&MA 6, Listeriosis of Sheep, published with permission of the Director, North Dakota Agricultural Experiment Station, Fargo.

**The authors are indebted to many veterinarians and livestock men who have aided in this study; to Mrs. Nora Edhlund, Mrs. Patricia Rheault, and Mrs. Muriel Stringer they are especially indebted for laboratory assistance.

fall of 1951, a new flock of western ewes was purchased and bred to rams from another source. On February 16, 1952, four ewes were brought to the laboratory with a history of abortions and circling. Listeria was recovered from these. Abortions continued, more fetuses were examined on March 17, 1952 and *Vibrio*

Fig. 1. Vibrionic abortion. Note sloughing.

fetus recovered. Abortions continued until natural lambing started in May.

On April 4, 1952 the owner submitted a bovine fetus from a heifer that had been in the lot with the sheep. *Listeria monocytogenes* was recovered. The heifer in this case made an uneventful recovery. This farm is the only one where listeriosis and vibriosis occurred simultaneously and there was an apparent cross infection of listeriosis from sheep to cattle.

Case 3. This is more or less a continuation of case 2. This owner purchased 100 bred ewes from the case 2 flock in the fall of 1951. These ewes started aborting in March 1952. Over half of the flock aborted from Vibrio infection but there was no indication of listeriosis.

Case 4. This flock had been gradually built up from a small flock of ewes without introduction of new animals. There was no history of listeriosis prior to 1948. However, a purebred ewe was added to the flock in 1947. She died in parturition in the spring of 1948, but had been ill previously. *Listeria monocytogenes* was recovered from her brain. This flock has been vaccinated yearly since 1948 with an experimental bacterin and no females have shown symptoms of listeriosis; however a nonvaccinated lamb died of listeriosis on July 7, 1949.

Case 5. This small flock of 55 ewes was bred to a ram from a flock with a previous history of listeriosis and was running with the flock of case 4. An aborted fetus was submitted on January 18, 1952 from which Listeria was isolated. This suggests that either the ram or one of the vaccinated sheep from case 4 flock was a carrier.

Cases 6, 7, and 8. Three herds were exhibited at a show. A heifer in case 6 showed symptoms of circling and died at the fair. *Listeria monocytogenes* was isolated at autopsy. About a month later a show heifer from case 7 became depressed and aborted a few days later. Listeria was isolated from the fetus. At about the same time a show bull belonging to case 8 exhibited circling symptoms but recovered.

Evidence in these cases strongly suggests that two of the herds were infected from a common source, probably the first animal to show symptoms.

Case 9. This purebred herd of cattle had no additions made to it for several years. There were no sheep on the premises. A neighbor's herd experienced a storm of abortions in the spring of 1952. The herdsman from the purebred herd visited the other farm and made no effort to clean his boots when he returned.

Fig. 2. Listeriosis in sheep. Note paralysis of the tongue.

Soon, abortions started in the purebred herd. *Vibrio fetus* was obtained from fetuses submitted for diagnosis. Diagnosis in the herd in which the original abortions occurred was made as vibriosis by the local veterinarian, but was not confirmed at the laboratory. History would indicate that in this case the infection was carried by the herdsman.

Case 10. A dealer imported western sheep in the fall of 1945. During the following winter he sold many of these animals into small flocks. Late in the winter some were lost that exhibited circling symptoms. There were also some abortions. *Listeria monocytogenes* was isolated from the brains of sheep submitted at various times. During 1947, listeriosis was diagnosed in five new flocks which had received sheep from this dealer. These cases

illustrate the strong possibility of non-clinical carriers of the Listeria organism.

Discussion

Listeria monocytogenes has been identified on 53 premises and *Vibrio fetus* on 18 premises. Listeriosis has occurred in 46 sheep flocks and seven cattle herds, while vibriosis has been found in 13 sheep flocks and five cattle herds.

The epizoology of the ovine listeriosis is quite clear, with outbreaks of the disease following introduction of purchased animals. In many cases, sheep from flocks with known history of listeriosis have been introduced into clean flocks which later became infected.

The epizoology of bovine listeriosis is not so clearly illustrated in the cases studied. There is evidence that listeriosis was contracted by one heifer from contact with infected sheep and, in other cases, that cattle became infected at a show.

In nearly all cases of ovine listeriosis, some radical change in management usually preceded outbreaks; withholding of feed and water from pregnant ewes was involved in one case; the feeding of silage was frequently thought to be the predisposing factor; heavy feeding in fitting for shows was another.

The epizoology of both bovine and ovine vibriosis is quite clear in most instances. Outbreaks of abortions have followed introduction of new animals into herds and flocks.

Losses due to abortions have varied widely with both diseases. In general, listeriosis losses have been much lower than vibrionic abortions, varying from 1% to 25%, while the vibrionic abortions frequently exceeded 50%. A second abortion has never been observed in either of these diseases.

Summary

A study of the epizoology of listeriosis and vibriosis indicates that spread of these diseases is primarily through introduction of carrier or infected animals. One example of a herdsman mechanically introducing vibrionic infection into a herd is related.

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TEPP-Lindane Bait for Fly Control

(*Continued from page 320*)

TEPP by use of a sprinkling can to areas frequented by flies.

Direct cutaneous application of the concentrated material (10.7% lindane and 4.7% TEPP) gave the expected toxicity based on the actual TEPP present and did not appear to be increased by the incorporation of lindane.

Calves treated directly with diluted material, cats exposed to treated surfaces under controlled conditions and dogs, man, chickens, geese, and ducks coming in contact with treated floors, developed no observable symptoms. There was no lindane or TEPP in milk from cows in dairies where the floors were treated with diluted material.

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Toxic Aspergilli Isolated from a Food Concentrate*

WALTER T. CARLL, D.V.M., Major V.C., JOSEPH FORGACS, B.S., M.S., Ph.D., and ALBERT S. HERRING, Camp Detrick, Frederick, Maryland

Many efforts have been made to determine the cause of hyperkeratosis in cattle. Although chemical causes have been advanced for this disease by McEntee, Hansel, and Olafson;[1] Wagner;[2] Bell;[3] and Miller, Bortree, and Shook,[4] no successful attempts have been made to determine the role of microorganisms.

A sample of food concentrate used by Olafson and McEntee[5] to produce hyperkeratosis consistently in cattle was used for the present microbiological studies**. Microscopic examination of the concentrate revealed presence of fungal mycelia on approximately 10% of the material examined. Subsequently, three species of Aspergillus were repeatedly isolated from the sample. These were inoculated on sterile dried bread and incubated for approximately 30 days. At this time, inoculated materials were dried, ground, and extracted with anhydrous ether for four hours. The ether extracts were evaporated and a known weight of each dried extract suspended in olive oil was tested topically for dermal reaction on the rabbit. The food concentrate of Doctor Olafson and untreated dried bread were treated in like manner. An inflammatory dermal reaction was observed in the rabbits that were tested with extracts from the Aspergillus species and from the concentrate. The extract from untreated bread gave no dermal reaction. One Aspergillus designated as P-3 was subjected to further study, because the ether extract from bread on which this fungus had grown gave a more pronounced dermal reaction than those on which the other two species had been cultured.

Bread on which Aspergillus P-3 was cultured for 15 days was divided into two lots. One lot was extracted with anhydrous ether. The extract was suspended in olive oil and tested for dermal reaction on the rabbit and a calf. The ether-extracted bread was fed to the calf by stomach tube. An inflammatory dermal reaction was observed in both the rabbit and calf tested with extract suspended in oil. The calf that received approximately 25 lb. of the extracted bread, remained normal.

The second lot of inoculated bread was ground and fed in an aqueous slurry by stomach tube. One calf received 23 lb. over a period of five days; the second calf received 16.8 lb. during a four-day period; a third calf, which served as a control, received 25 lb. of untreated dried bread over a five-day period. The first animal died on the sixth day, and the second died on the fifth following initiation of the experiment. The third animal remained normal. The first two animals, after the first dose, showed moderate depression, slight anorexia, lacrimation, and salivation. During succeeding periods, animals exhibited greater malaise, progressively congested mucous membranes, profuse fetid diarrhea, dehydration, and complete anorexia. These conditions existed until death. Gross autopsy findings included liver and kidney changes with hemorrhages in the adrenals, omentum, mesentery, lungs and superficial muscle over the left side of the thorax. The small intestine contained blood-tinted material in the lumen. On histological examination the following were found: In the kidney, slight dilatation of collecting tubules, with hemorrhages and congestion in the cortex; necrosis, and congestion of the sinusoids in the liver; submucosal tissue of the gall bladder edematous; mucous lining of the omasum congested; small intestine congested, with some capillary hemorrhage in the mucosa; cecum slightly hemorrhagic and congested; in the adrenals, areas of cortical hemorrhages; submucosa of the trachea hemorrhagic and lungs edematous, congested, and hemorrhagic with areas of bronchial pneumonia; mediastinal, intestinal, and hepatic lymph nodes congested and hyperplastic. Mycological examination of the tissues revealed only presence of Aspergillus P-3 in the digestive tract. The fungus was not found in the other tissues.

Since the two animals that were fed large doses of inoculated bread died acutely, studies were undertaken to determine the effects of prolonged feeding of sublethal amounts. One calf was fed sublethal doses of bread crumbs on which the fungus had been cultured for 15 days. After being fed 17.6 lb. in nine doses over a period of 31 days, the animal exhibited profuse lacrimation from both eyes, slight congestion and icterus of conjunctival mucous membranes, and intermittent salivation. Skin on both sides of the neck and anterior part of the shoulders appeared to be thickened and arranged in bold folds in parallel alignment along the short axis of the neck. Although appetite remained normal, there was evidence of slight cachexia.

(*Continued on page 342*)

*This preliminary report was presented at the Fourth Inter-regional Research Conference of Cooperators on X Disease (Hyperkeratosis) of Cattle, held at Tennessee Agricultural Experiment Station, University of Tennessee, Knoxville, on August 4, 1952.

**The authors express their gratitude to those who have contributed their efforts to this research.

SMALL ANIMAL PRACTICE
V M

Toluene (Methylbenzene) For Intestinal Nematodes In Dogs And Cats

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IN limited trials[4] in 1947, toluene (sulfur-free) exhibited marked anthelmintic activity against intestinal roundworm parasites in dogs although Hall and Wigdor,[7] about two decades earlier, found that the chemical showed no significant action in this host. Nevertheless, the antiparasitic action of toluene has been confirmed in dogs,[1,10] and has been demonstrated also in cats,[2,9] horses,[6,13,14,15] swine,[12] and chickens[13]. It seems likely, therefore, that the product employed by Hall and Wigdor differed in some manner from that available to subsequent workers.

Because several proprietaries† containing toluene are available to small animal practitioners, it seemed desirable to present additional critical data on the action of this chemical in dogs and cats, to compare its performance with that of n-butyl chloride which has been generally regarded as the drug of choice, and to evaluate the net usefulness of these compounds as treatments for the common intestinal roundworm parasites. Data were obtained over a period of approximately seven years, from 1947 to 1953.

Test animals, all with naturally acquired infestations, were mixed breeds and ranged from two months to several years of age. Experimental procedure was essentially as described heretofore[4].

Results

Dogs. Data are given in table 1. At a dose rate of approximately 0.1 cc. per lb. of body weight, toluene removed, in the aggregate, 97% (265) of 272 ascarids from 15 dogs, 87% (5,867) of 6,711 hookworms from 56 dogs, and 39% (1,077) of 2,720 whipworms from 42 dogs. Eight of 60 animals vomited shortly after treatment, but there was no apparent nausea and no inappetence when feed was given two hours after medication. One puppy exhibited slight, temporary incoordination shortly after dosing and was weak and dehydrated at the end of the experimental period. The only significant lesions found at autopsy were small areas of necrosis throughout the small intestine. The lesions probably are not attributable to the drug, however, since three litter mates treated concurrently showed no evidence of intoxication or enteric necrosis.

In toxicity trials, one dog was given toluene at a dose rate of 0.5 cc. per lb. of body weight after a fast period of 24 hours. The animal vomited about 30 minutes after dosing, but there was no apparent nausea and all feed was promptly eaten two hours after medication. Treatment removed all of 344 hookworms and 70% of 20 whipworms. No significant changes occurred in the hematocrit level of another dog, weighing 36 lb., that received a therapeutic dose (4.0 cc.) of toluene daily for five days. The first of several determinations was

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†Anthol—Jensen-Salsbery Laboratories, Inc., Kansas City, Mo.; methacide—Warren-Teed Products Company, Columbus, Ohio; paracide capsules—Norden Laboratories, Lincoln, Neb.; vermiplex—Pitman-Moore Company, Indianapolis, Ind.; and wurm kaps—Haver-Glover Laboratories, Kansas City, Mo.

made two weeks before treatment, and the final reading was obtained six weeks following the final dose. This test was made because blood dyscrasias have been associated with the closely related chemical, benzene, although, according to Williams,[10] the metabolism of the two substances is dissimilar.

In dosages recommended for use against ascarids and hookworms, n-butyl chloride removed, in the aggregate, all of 32 ascarids from five dogs; 60% (444) of 732 hookworms, and 7% (125) of 1,747 whipworms from 14 dogs. On the basis of fecal examinations and postmortem worm counts, four additional animals were apparently freed of hookworms although none were recovered in the feces after treatment. Six of the 18 animals vomited shortly after dosing, but there was no apparent nausea or inappetence.

At the larger dose rate recommended for use against whipworms,[8] the drug removed 66% (130) of 196 whipworms from four dogs, both of two ascarids from one dog, and 99% (172) of 173 hookworms from three dogs. One additional animal was apparently freed of hookworms on the basis of fecal examinations and postmortem worm counts. Three dogs vomited but the treatment was well tolerated otherwise.

Cats. Data are given in table 2. At dose rates of 0.1 and 0.2 cc. per lb. of body weight, toluene removed, in the aggregate, 99% (205) of 207 ascarids from 26 cats, and all of 28 hookworms from three cats. Six additional animals were apparently freed of hookworms as judged by fecal examinations and postmortem worm counts. Twelve of 31 cats vomited and one showed slight, transient incoordination shortly after treatment, but there was no apparent nausea or inappetence. Temporary incoordination was exhibited by one parasite-free cat that received a dosage of 0.4 cc. per lb.

In dosages ranging from 0.1 to 0.3 cc. per lb. of body weight, n-butyl chloride removed, in the aggregate, 92% (117) of 127 ascarids from 13 cats and 6% (1) of 15 hookworms from one cat. The data relative to hookworms are of doubtful significance, however, because

TABLE 1. Efficacy of Toluene (approximately 0.1 cc/lb.) and n-Butyl Chloride (recommended doses) Against Intestinal Nematodes of Dogs

Drug	No. of dogs	Weight lb.	Dose cc.	Parasites	recovered	left	Efficacy %	No. of tests
Toluene	5	3-5.5	0.3-0.55	Ascarids	216	7	96	5
				Hookworms	58	9	86	5
				Whipworms	0	30	0	5
	12	6-10	1.0	Ascarids	44	0	100	8
				Hookworms	2813	347	89	11
				Whipworms	0	12	0	3
	11	11-15	1.5	Ascarids	1	0	100	1
				Hookworms	1222	168	87	11
				Whipworms	327	310	51	10
	12	16-20	2.0	Ascarids	4	0	100	1
				Hookworms	1067	48	95	12
				Whipworms	365	384	48	8
	5	21-25	2.5	Hookworms	312	225	58	5
				Whipworms	13	248	4	4
	8	26-30	3.0	Hookworms	330	46	87	7
				Whipworms	187	636	22	7
	6	31-35	3.5	Hookworm	53	1	98	4
				Whipworms	152	23	86	4
	1	59.0	5.0	Hookworms	12	0	100	1
				Whipworms	33	0	100	1
n-Butyl Chloride	1	5.0	1.5	Ascarids	13	0	100	1
				Hookworms	5	0	100	1
	3	5-10	2.0	Ascarids	18	0	100	3
				Hookworms	134	28	82	3
	5	10-20	3.0	Ascarids	1	0	100	1
				Hookworms	237	205	53	5
				Whipworms	70	402	14	5
	9	20-40	4.0	Hookworms	68	55	55	5(4)
				Whipworms	55	1220	4	9
	4	15-49	12-25	Ascarids	2	0	100	1
				Hookworms	172	1	99	3(1)
				Whipworms	130	66	66	4

( )—Eggs found on fecal examination before treatment but no worms recovered from feces or at autopsy.

some of the drug spilled into the mouth and vomition occurred immediately. Two additional cats vomited and one showed slight, transient incoordination, but there were no other unfavorable reactions to the treatment.

Discussion

Considering all available information,[3,4,10] including data presented herein, therapeutic doses of toluene removed 96% (815) of 846 ascarids from 59 dogs, 87% (6,659) of 7,579 hookworms from 108 dogs, and 41% (1,198) of 2,881 whipworms from 48 dogs. (Table 3). Curiously, comparable data for n-butyl chloride are rather limited despite the many years that this chemical has been employed as a useful anthelmintic by small animal practitioners. Indeed, the only available data obtained specifically with the recommended schedule of dosages[8] appear to be those reported herein (*vide supra*) although other experimental data have been published[8,17] which show the anthelmintic action of the drug against these parasites. Direct comparisons of the efficacy of the two treatments are difficult because of the paucity of data obtained with the dosage schedule for n-butyl chloride in common usage. In our trials with the ascarid and hookworm dose schedule, n-butyl chloride removed all ascarids but was only 60% effective against hookworms; it removed only 7% of the whipworms from these animals, but was 66% effective in four dogs that received the larger dosage recommended for use against these worms. Although the data are limited, performance of the drug against hookworms was somewhat poorer than expected in view of earlier reports[8,17] which showed that slightly lower dosages, in the aggregate, were about 86% effective against these worms.

With respect to whipworms, reasonable interpretations of anthelmintic action are much more difficult than obtains with ascarids and hookworms because efficacy of canine trichuricides is contingent upon the fortuitous entrance of the drug into the cecum. On this account, Harwood, *et al.*[8] suggested a different method of determining trichuricidal efficacy, namely, by calculating the average of the several individual efficacies. An analysis of their data, however, shows only a rather insignificant difference in the aggregate efficacies obtained by the two methods and does not seem to warrant departure from the established procedure. For example, at a dose rate of 1.0 cc. per kg. (Harwood, *et al.*, tables 1 and 2), n-butyl chloride removed 47.2% (1,365) of 2,889 whipworms from 54 dogs, whereas an average of the results obtained in the several individual trials indicated an efficacy of 52.6%. Moreover, in the 24 trials with doses larger than 11.0 cc. (doses which were relatively more effective than smaller amounts) the percentage efficacies determined by the two methods were 59.9 and 63.5, respectively.

Findings of these investigators in the aforementioned trials formed the basis for their recommended schedule of doses[8] for use against whipworms, doses three to five times larger than those for ascarids and hookworms. It is interesting to note from their data, however, that: (1) doses larger than 11.0 cc. were less than 5% effective in nearly a third of the test animals, (2) the largest dose employed was wholly ineffective, and (3) doses of 11.0 cc. or less were 50 to 100% effective in nearly half the cases. Furthermore, results obtained in the individual trials, especially those involving two or more trials with a single animal, seem to indicate that the efficacy of canine trichuricides is largely dependent upon factors other than the size of the dose. It is our opinion that the widely variable conformation of the cecum, the tonus of the ileocecal valve,

TABLE 2. Efficacy of Toluene and n-Butyl Chloride Against Intestinal Parasites of Cats

Drug	No. of cats	Weight lb.	Dose cc./lb.	Parasites	recovered	left	Efficacy %	No. of tests
Toluene	29	1.6-6.75	0.1	Ascarids	203	2	99	25
				Hookworms	28	0	100	3(5)
				Taenia	1a	0	100	1
	2	4-4.5	0.2	Ascarids	2	0	100	1
				Hookworms	0	0	?	(1)
	1	5.0	0.4	None				
n-Butyl Chloride	4	2.25-5.0	0.1	Ascarids	57	7	89	4
	5	2.0-8.0	0.2	Ascarids	17	0	100	5
				Dipylidium	0	8	0	1
	4	2.0-6.0	0.25	Ascarids	24	3	88	3
				Hookworms	1	14	6	1
	2	2.75-7.0	0.3	Ascarids	19	0	100	1

a—in vomitus; ( )—see table 1.

TABLE 3. Aggregate Efficacy of Recommended Doses of Toluene and n-Butyl Chloride in Dogs

	Toluene			n-Butyl Chloride		
	Efficacy %	Worms removed/present	Dogs no.	Efficacy %	Worms removed/present	Dogs no.
Ascarids	96	815/846	59	100	32/32	5
Hookworms	87	6659/7579	108	60	444/732	14
Whipworms	41	1198/2881	48	66	130/196	4

and the presence of hard fecal masses, gas, mucus, etc. in the organ, are determining factors in this regard. Thus, consideration of all available information tends to support the thesis that trichuricidal action is largely fortuitous and that reasonable interpretations of efficacy necessitate substantially more data than obtains with ascarids and hookworms.

Although diethylcarbamazine[9,11] is the preferred treatment in ascariasis of cats, toluene or n-butyl chloride may be indicated in hookworm infections and in mixed infections of both types of worms. In this connection, toluene compares favorably with n-butyl chloride for the removal of both ascarids and hookworms, although data relative to the use of these drugs against the latter are limited. In all trials with therapeutic doses,[3] including data presented herein, toluene removed 98% of 389 ascarids from 44 cats and 89% of 199 hookworms from 16 cats; doses exceeding the therapeutic level[9] were less effective and elicited toxic reactions in about half the test animals. N-butyl chloride removed 92% of 127 ascarids from 13 cats and 6% of 15 hookworms from one cat. Although toluene has been reported to be effective against whipworms in this host,[2] the data were probably occasioned by misidentification of capillarid eggs in fecal examinations; it has not been conclusively established that whipworms occur in domestic cats in this country[5]. For the most part, toluene was well tolerated in therapeutic doses although vomition, unattended by nausea and inappetence, occurred fairly commonly. Toxic symptoms including muscular tremors, unsteady gait, vomition, and death were observed by Hitchcock in young kittens that were given doses exceeding the therapeutic level of 0.1 cc. per lb. of body weight.

Summary and Conclusions

1. In therapeutic doses, approximately 0.1 cc. per lb. of body weight, toluene removed 97% of 272 ascarids from 15 dogs, 87% of 6,711 hookworms from 56 dogs, and 39% of 2,720 whipworms from 42 dogs. With the exception of occasional vomiting, the drug was well tolerated in all respects.

2. In doses recommended for use against ascarids and hookworms, n-butyl chloride removed all of 32 ascarids from five dogs, and 60% of 732 hookworms and 7% of 1,747 whipworms from 14 dogs; at the larger dose rate recommended for use in whipworm infections, the drug was 66% effective against 196 whipworms in four dogs. Vomition occurred fairly commonly in both groups, but there was no apparent nausea or inappetence.

3. Therapeutic doses of toluene, approximately 0.1 cc. per lb. of body weight, removed 99% of 205 ascarids from 25 cats and 100% of 28 hookworms from three cats. Several animals vomited but there was no apparent nausea or inappetence.

4. In dosages ranging from 0.1 to 0.3 cc. per lb. of body weight, n-butyl chloride removed, in the aggregate, 92% of 127 ascarids from 13 cats and 6% of 15 hookworms from one cat. The drug was well tolerated, causing only occasional vomition.

5. In all available trials to date, therapeutic doses of toluene removed 96% of 846 ascarids from 59 dogs, 87% of 7,579 hookworms from 108 dogs, 41% of 2,881 whipworms from 48 dogs, 98% of 389 ascarids from 44 cats, and 89% of 199 hookworms from 16 cats.

6. The dosage of toluene for puppies and kittens should be limited to 0.1 cc. per lb., but some latitude is permitted in this regard with older animals.

7. Toluene is a safe and effective treatment for removal of ascarids and hookworms from dogs and cats, but it is not uniformly effective against the dog whipworm. The drug compares favorably in efficacy and safety with n-butyl chloride as a general anthelmintic for small animals and appears to be superior to the latter in simplicity of dosage and range of action.

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(*Continued on page 341*)

Veterinary Public Relations*

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THERE is little in the curriculum of veterinary colleges that contributes to an understanding of the fundamental problems of veterinary practice and the relationships of the practitioner with his clients and the general public. Although some schools are endeavoring to fill this deficiency with a few brief lectures during the senior year, little is being accomplished to aid the new graduate in his transition from student to practicing veterinarian.

Practitioners have found that there are factors, in addition to a thorough knowledge of veterinary medicine, that are of utmost and vital importance in the conduct of a successful practice. One of these factors is the relationship of the profession to its clientele and to the public as a whole.

What is Veterinary Public Relations?

Veterinary public relations and veterinary publicity are not synonymous and must not be confused. Veterinary public relations is the attitude, opinion, and behavior of the public towards the profession and includes all factors that influence the opinion of the people at large. Publicity is only one phase of public relations. Paid advertising, distribution of literature, buying time on the radio—all the publicity in the world will not sell a service that does not satisfy the client. Publicity must follow action that is designed to benefit the public as a whole. Public confidence in the veterinary profession can not be gained until all factors inimical to the client's interests are reduced to a minimum. Benefit of the animal owner and the general public must be the sole basis of good public relations.

Importance of the Veterinary Profession

It will be readily conceded that the veterinary profession should occupy an important place in the animal industry of this country. Animal owners are being confronted continually with many questions that require for their answer the highly technical knowledge of veterinary science. These questions are becoming more numerous and more difficult. With growing knowledge of diseases affecting animals, more is and will be expected of the veterinarian in the future than has been the situation in the past.

Veterinary work is of great importance. One occasionally has cause to wonder whether this

Winner in Associated Serum Producers National Essay Contest

Dr. Carl M. Foster

The author of the accompanying article, Dr. Carl M. Foster, was winner of the $300. second prize in the Associated Serum Producers national essay contest this spring.

Doctor Foster was born in San Diego, California, June 11, 1921. He attended grade schools in California and high school in Penalosa, Kansas. He enlisted in the Air Force shortly after Pearl Harbor and was commissioned December 17, 1942. His service overseas included action in the Aleutian Islands, during the 1943 campaign, where he participated in 42 bombing missions. He received the Distinguished Flying Cross, the Air Medal with one Oak Leaf Cluster, and the Purple Heart. He was discharged January 3, 1946 with the rank of First Lieutenant.

In September 1946, Doctor Foster entered Kansas State College as a preveterinary student and in 1948 he was accepted by the School of Veterinary Medicine. Recurrences of his service-connected disabilities forced him to seek a more favorable climate, and, in September 1950, he was accepted as a transfer student at Colorado A. and M. College, where he received his D.V.M. degree June 5, 1953.

Doctor Foster is married and the father of two sons, Carl Michael, seven, and Richard Lyle, two.

*Second prize-winning essay, Associated Serum Producer's National Essay Contest on "Veterinary Public Relations," 1953.

fact is sufficiently appreciated by the laity in general.

Many forces have been in operation, trying to minimize the real value of the veterinarian and his profession. Too much emphasis has been placed on administration of treatments without taking into consideration fundamental factors, such as diagnosis of the disease or condition. It is difficult enough for the trained veterinarian to apply intelligent treatment; how much more difficult it must be for the untrained individual to arrive at proper therapeutic principles—it can not be accomplished with any degree of success. It is customary for many owners of animals to request veterinary services only when animals are seriously ill and beyond what they consider their own personal medical skills, or when large losses have already occurred.

This situation, fortunately, does not always exist, and it is possible the day will arrive when the veterinary profession will be given an opportunity to exert its full value, skill, and knowledge for the livestock and pet animal owners of this country. This, in my opinion, is largely a matter of education. The public must come to realize that it is medically and economically unsound to rely on unscientific and empirical methods in diagnosis, treatment, prevention, and control of diseases affecting animals.

Education of the Public

In education of the laity to the real significance and importance of the veterinary profession, there are many problems to be solved. Ethical means must be employed in keeping the public informed of the need and importance of veterinary services, and in directing this information into proper channels. In some cases, attempts have been made to direct this information through other channels, thus giving a false sense of security—sometimes with disastrous results to owners of livestock, poultry, and pet animals. It would seem logical to employ veterinarians to cope with these serious problems.

Education in the Fundamentals of Veterinary Science

In treatment and eradication of disease in our domestic animals, every intelligent owner must be enlightened, if satisfactory cooperation is to be obtained. One may understand the methods by which a disease can be controlled, but knowledge would be futile and negligible if adoption and execution of control measures were medically and economically unsound. The health of the nation's livestock is not the responsibility solely of the veterinary profession; neither is it the responsibility of the animal owners. It is the joint responsibility of the profession and the owners. If we are to solve these problems, we must recognize this dual responsibility, and we must admit the necessity of a partnership in the effort.

The benefit from campaigns aiming to acquaint the farmer, the pet owner, and the public with the basic principles of veterinary science is a very important factor in the progress and future of the veterinary profession. General dissemination of scientific knowledge among the people will lead to more and greater opportunities than ever before for competent veterinarians, and to a more proper evaluation of our profession. The well-educated owner appreciates the value and worth of expert knowledge and advice. He is a hundred-times more likely than the uninformed individual to call upon the veterinarian for aid, but he rightfully demands the best in veterinary services.

Owners of livestock, like all other classes of people, are reaching a higher level of general education; they are becoming better acquainted not only with the facts concerning animal husbandry, but also with the sciences which underlie the veterinary art, and they are requiring of the practitioner a more expert knowledge as well as a more thorough, comprehensive, and scientific training. If the practicing veterinarian is to command the respect, confidence, and patronage of an enlightened and well-educated clientele, he must himself have a good general education as well as a mastery of fundamentals of veterinary science and their special applications.

Enlightenment of livestock and poultry owners in basic principles of sanitation, nutrition, and hygiene, will help make these people more capable of resisting the propaganda of interests whose only motive is selfish exploitation.

Relations with the Press

Remarkable "cures" and "great discoveries" in the field of veterinary medicine have provided much interesting, although sometimes inaccurate, information to readers of farm journals, stockmen's periodicals, and various publications pertaining to animals. However, despite the ludicrous and sometimes unfortunate veterinary "stories" which are published, there is more accurate reporting of matters pertaining to animal diseases than the veterinarian generally believes. Most editors recognize their obligation to provide only facts. Press services supplying national news have

been equally cognizant of their responsibility, and employ experts who carefully check the accuracy of news releases. There is, of course, much room for improvement. The press is still guilty of sometimes sacrificing accuracy for the sake of reader interest. By so doing, they unjustifiably arouse the hopes of many clients, causing distress and needless waste of money.

Few men will deny that the public is entitled to information about recent developments in veterinary medicine. There should be no objection if articles of public interest are released through, and with the approval of local, state, and national veterinary associations. Just as in all groups, there are extremists in the profession who would, if they could, exclude all veterinary information from the press. Such an attitude can not be justified and should not be tolerated.

There is no defense for the publicity-seeking veterinarian, whether he be of high or low standing. His behavior creates ill-feeling among the profession; by his optimistic statements he may arouse false hopes in many clients. Usually he gives an exaggerated and erroneous impression of his own abilities. Obviously, he violates the ethics of his profession by employing methods to focus the attention of the public upon himself.

In several cities and states, veterinary organizations provide weekly and monthly news releases devoted to animal diseases, written for the laity in an interesting and understandable manner. The public relations (publicity) campaign of the American Foundation for Animal Health, under sponsorship of the Associated Serum Producers, can not be commended too highly. This group of independent companies has spent hundreds of thousands of dollars during the past two decades for ethical publicity for the veterinary profession. The Associated Serum Producers consists of companies who sell exclusively to veterinarians, and the tremendous publicity program is financed by an assessment of each member company on the basis of volume of business.

The Principles of Medical Ethics of the American Medical Association, includes, in chapter I, section 5, the following: "Many people, literate and well educated, do not possess special knowledge of medicine. Medical books and journals are not easily accessible or readily understandable.

"The medical profession considers it ethical for a physician to meet the request of a component or constituent medical society to write, act, or speak for general readers or audiences. The adaptability of medical material for presentation to the public may be perceived first by publishers, motion picture producers, or radio officials. These may offer to the physician opportunity to release some article, exhibit, or drawing. *Refusal to release the material may be considered to be a refusal to perform a public service,* yet the compliance may bring the charge of self-seeking or solicitation. In such circumstances the physician should be guided by the decision of official agencies established through component and constituent medical organizations."

Veterinarians should take note of these facts, and similar provisions should be included in the Code of Ethics of the American Veterinary Medical Association.

Public Speaking

The art of public speaking is one in which few of our profession become adept. Veterinarians who are accomplished speakers stand out conspicuously from their less articulate colleagues. If, in addition, they are able men, they command attention and interest far beyond those who may otherwise be equally well qualified. Needless to say, such speakers are in great demand, and, wherever they go, they are welcomed by large numbers of their colleagues and by various lay groups.

One of the most important factors in the public's growing appreciation of the veterinary profession is the dissemination of information among the people. The practitioner's role in this movement is that of a teacher, and as the movement progresses he will be called upon with greater frequency to discuss various phases of animal health. To do justice to himself, and to his listeners, he must not only make himself understood, but also possess speaking ability.

Just as the theoretical training received in the veterinary school must be supplemented by experience, so the knowledge of "how to speak" must be developed by practice. Such opportunities are afforded, for example, at veterinary association meetings when scientific presentations are opened for discussion. Stockmen's organizations, dog clubs, etc., are constantly looking for speakers who have something to say, particularly if the topic pertains to animal health. The veterinarian who is really desirous of acquiring facility of expression before an audience will not lack opportunities for self-improvement.

Professional Responsibilities to the Clientele

The members of the profession itself are very potent factors in bringing about better

understanding of the veterinary profession by the general public. This can be accomplished by honest and ethical performance of all professional services, active participation in civic affairs, and assisting in many other ways in building a happy, prosperous community.

If veterinarians are to instill confidence in the people at large, they must, as individuals, perform all professional activities as honestly, conscientiously, and as ethically as possible. We can not afford to be indifferent to practices that have brought unfavorable criticism, and we can not be too insistent on a service that will establish the greatest confidence in our clients. Carelessness, indifference, and lack of professional ability on the part of a few men have invited criticism and doubt to the veterinarian. Only by conscientious attention to technical details in diagnostic, prophylactic, and therapeutic procedures can we fulfill professional obligations to our clientele. A man is a real veterinarian, not only by virtue of his diploma and state license, but by virtue of the fact that his mind, his heart, and his life are bound up in his work.

Scientific progress is not accomplished by acquisition and accumulation of knowledge, by an extensive array of shiny instruments, or by a modernistic hospital, but follows only when these are properly utilized. While it may be true that success in practice comes first to those whose appearance and equipment impress their patrons, there must also be evidence of willingness to study new methods and to bring new research work into the field, a definite purpose or action, and an understanding of the most recent methods in veterinary medicine.

It is a professional and community obligation to be efficient. Efficiency implies not only knowledge of facts but also ability and readiness to impart it to others and to enlighten the people as a whole. The mere fact that we are familiar with the nature, etiology, bacteriology, pathology, and course of diseases affecting domestic animals does not in itself help the veterinary profession. We must know as well how to arouse sufficient interest to secure a harmonious enforcement of preventive measures by the public and for the public.

Civic Responsibilities as a Professional Man

As to civic duties, besides increasing our own professional abilities and usefulness, we should participate and maintain an active interest in the community. Genuine opportunities are open on county boards, city and village councils, school boards, volunteer health organizations, parent-teacher associations, chambers of commerce, civil defense units, and service clubs.

Volunteer health organizations offer the widest possibilities to the veterinarian. In this category are organizations devoted to the prevention and control of cancer, tuberculosis, heart disease, infantile paralysis, and so on. Too often the veterinarian shows little interest in these groups. He should, of course, take a hand in their affairs, devoting what time he can to them. He will be guided in his choice of organizations by his interests. Their activities should, in at least some respects, parallel his. Many of these groups are in dire need of competent leadership; the services of qualified and genuinely interested veterinarians would be more than welcome.

Nearly every parent-teacher association, civic organization, or service club sponsors some health activity. Here again the veterinarian can perform a much needed service. If nothing more, he can make the veterinary profession and its problems better understood by the organization's members.

The majority of people do not appreciate the abilities of the veterinarian, thinking of him only for his efforts with sick animals. The average citizen is not acquainted with his value in safe-guarding human life from the diseases communicable from animals to man. If we take an active part in civic affairs for which our professional background qualifies us, it will tend indirectly to enhance the public esteem of our profession.

Many veterinarians manifest little, if any, interest in public affairs. Political activity, as many view it, is synonymous with graft, subterfuge, and deceit. It should be acknowledged that the veterinarian's distaste for politics is common to a great number of citizens. The veterinary profession should realize, however, that it can no longer ignore those who make and administer laws unless it is willing to accept such restrictions as they may place upon the veterinarian. We can contribute our share toward better government by accepting those responsibilities for which we are well qualified.

Conclusion

The public is willing to accord to veterinarians and the veterinary profession any position which they demonstrate they are entitled to occupy; but, before advancing them, it must be positively demonstrated that they possess a thorough knowledge of their subject, that the knowledge is applied in a scientific and careful manner, and that the public can be confi-

(Continued on page 341)

EDITORIAL COMMENTS

Cooperative Veterinary Service

Mr. Herbert Hogsett, a well known poultry breeder and hatcheryman in southern California, recommends a cooperative veterinary service for poultrymen as an effective, reasonable, and efficient means of securing much needed veterinary help in many poultry areas (*Nulaid News*, 31:11 [May], 1953).

The following is a quoted excerpt from his article appearing in the official publication of Poultry Producers of Central California:

"The increasing seriousness of the disease problem, particularly the respiratory complex, in our more concentrated poultry areas presents a challenge to poultrymen to do something about it. We have been thinking for some time that perhaps a step in the direction of self-help on this problem might be the formation of a group of poultrymen who would contract the services of a poultry veterinarian. We feel that this presents an opportunity for a veterinarian to get established with a guaranteed income the first year and an opportunity for poultrymen to get veterinary service at a reasonable figure."

Mr. Hogsett suggests that a group of poultrymen could contract with a veterinarian on a flat monthly fee basis, or a fee based on the number of birds in the flock with a yearly minimum guarantee. For this fee, the veterinarian would make a specified number of calls to each ranch to examine the flock for possible diseases and to advise the poultryman on preventive procedures. Additional calls or service would be charged on a regular fee basis.

This plan is one that should be given serious consideration by the veterinary profession. Again quoting Mr. Hogsett:

". . . we have felt that commercial veterinary service for poultrymen has long been needed and this appeals to us as a probable means of getting it started. If several groups were able to do this, these veterinarians working with our state pathological laboratories and the veterinary department of the university would certainly be in a better position to do something quickly about an epidemic that comes in suddenly. There is no doubt in our minds that many of our serious disease problems would not become that, if there was early diagnosis and prompt action. . . . What might be a 'mild' infection if stopped early, can become a 'nasty' infection and a major problem if allowed to travel unchecked."

By such a plan, an excellent program of preventive veterinary medicine could be established in a community, which would be profitable to all concerned.—W. R. H.

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Federal Regulations Pertaining to Vesicular Exanthema

Amended regulations restricting the interstate movement of swine and swine products, as part of cooperative efforts of federal and state disease-control officials to eradicate the swine disease, vesicular exanthema, became effective July 1, 1953.

The new regulations continue federal quarantines in states and areas in which swine are infected with vesicular exanthema. As in the past, swine from a nonquarantined area which have not been fed garbage, and which are not and have not been affected by vesicular exanthema, and the products of such animals, may be moved interstate without restriction.

Also, as in the old regulations, swine may be moved interstate from a quarantined area only to an approved establishment for immediate slaughter and special processing if (a new provision) they are accompanied by a certificate showing that they have had proper veterinary inspection just before being moved and that they exhibit no evidence of the disease.

Swine products previously could be moved from a quarantined area to an approved establishment for special processing. A new requirement is that they be accompanied by a permit obtained by the owner or shipper from an inspector of the BAI.

Previous regulations required the cleaning and disinfection of all conveyances hauling hogs, and the cleaning and disinfection of facilities used for feeding, watering, and resting the animals from a quarantined area. The new regulations make it mandatory to clean and disinfect all vehicles hauling swine interstate a distance of 200 miles or more, regardless of whether they originate in a quarantined or nonquarantined area, and the cleaning and disinfection of all facilities used for feeding, watering, and resting swine after each such use, throughout the United States.

Four other principal clauses of the regulations are entirely new:

Swine from a nonquarantined area which have been fed cooked garbage (heated at boil-

ing temperature for 30 minutes) may be moved interstate only if a state or federal inspector certifies that they have not been fed raw garbage or been in contact with hogs fed raw garbage for 30 days, and have not been infected with or exposed to vesicular exanthema.

Swine which have been fed raw garbage may be moved interstate from a nonquarantined area only to an approved establishment for immediate slaughter and processing if they are accompanied by a federal inspector's permit and are certified by a veterinarian to have shown no evidence of disease.

Products of swine which have been fed raw garbage may be moved interstate from a nonquarantined area to an approved establishment for special processing provided that they are accompanied by a permit from a federal inspector.

The order allows those now feeding raw garbage a period of six months in which they may move their hogs interstate after 30 consecutive days of feeding cooked garbage, provided they are not in a quarantine area, and if the animals are accompanied by a certificate stating that they have not received raw garbage for 30 days and that inspection of the herd disclosed no symptoms of vesicular exanthema.

Federal indemnity payments for infected hogs fed raw garbage were discontinued as of July 1, 1953.

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Foot-and-Mouth Disease Outbreak in Mexico Under Control

Moving with speed and efficiency, officials of the Joint Commission in Mexico have supervised slaughter of several hundred head of cattle, sheep, swine, and goats in the quarantine area designated. No infections have been discovered outside the zone of quarantine, although additional infected herds have been revealed by frequent inspection of all animals in the quarantine area.

The United States-Mexico border was closed to importation of all meats except canned goods by order of the Secretary of Agriculture as soon as infection was confirmed. It will be effective for at least one year, regardless of whether further infection is discovered. No vaccination of susceptible stock is contemplated.

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Hirschsprung's disease, causing chronic constipation in the canine patient, is often found associated with esophageal dilatation. — *Dr. Wayne H. Riser, Skokie, Ill.*

Doctor Armistead Named Dean at Texas

Dr. W. W. Armistead, professor of veterinary medicine and surgery at the A. & M. College of Texas, has been named dean of the School of Veterinary Medicine. He will succeed Dean I. B. Boughton who has requested to be relieved of his executive duties because of ill health. Dean Boughton will devote his time to teaching and research.

Dr. Willis W. Armistead

Doctor Armistead received his veterinary education at the Texas school, graduating in 1938. Thereafter, he was associated in practice with Dr. W. G. Brock, Dallas, Texas, until 1940 when he accepted a position as instructor in veterinary medicine at the A. & M. College of Texas. His work was interrupted in 1942, when he was called to army service; after military service he returned to Texas as assistant professor. He received his professorship in 1947.

Doctor Armistead was granted leave to pursue advanced training in 1949-50, and received his Master of Science degree from Ohio State University in 1950. He recently returned from the University of Minnesota where he completed course work, residence, and preliminary examinations for his Ph.D. degree.

A versatile and popular public speaker, Doctor Armistead has appeared on many veterinary programs. He is also the author of numerous articles on surgical subjects, and has been affiliated as one of the editors of the *North American Veterinarian* for the last three years. Active in association work, he served as president of the State Veterinary Medical Association of Texas in 1947-48.

Television Demonstrations at Veterinary Meetings

An outstanding development in post-graduate education of veterinary practitioners has been the advent of closed-circuit telecasting at veterinary meetings. It was demonstrated at the A.V.M.A.'s Milwaukee and Atlantic City conventions (Aug. 20-23, 1951 and June 23-26, 1952) and at the A.A.H.A.'s Pasadena and Minneapolis meetings (Apr. 30-May 3, 1952 and May 7-9, 1953), that increased use of this media offers unlimited possibilities in the future, not only in the field of veterinary education, but also in public relations.

These fine demonstrations, so thoroughly enjoyed by veterinarians attending the conventions, have been presented as a service by Allied Laboratories, Inc., and the Radio Corporation of America.

Dr. Donald H. Clifford (left) and Dean Mark W. Allam demonstrate ovariohysterectomy at the A.A.H.A. Minneapolis meeting, May 7-9, 1953.

The basic educational role fulfilled by television at veterinary conventions has, of course, already been realized. It is firmly rooted in the theorem that "one picture is worth 1,000 words." It can visually impress difficult procedures not lending themselves well to verbal presentation, and supplement the view with narrative descriptions of technics, drugs used, dosages, and other information.

Harbingers of other educational potentialities are (1) the rapid improvements seen in presentation, (2) closed-circuit color television, and (3) remote controlling.

Previously, direct viewing on a few sets limited the number of possible spectators. Multiple-screen technics have been shown to be practical and effective. The telecasts are thus made available to large groups.

Closed-circuit color television and remote controlling, such as that inaugurated at the Annual Conference for Kansas Veterinarians at Manhattan, June 5-6, 1953, is another valuable innovation. This meeting was notable because of its color telecasting, and introduction of a remotely controlled camera operated at the receiving set. Such control has the advantages of eliminating an operator from the demonstration area, affording a wide range of visibility for the audience, and absence of distraction.

Color television for veterinary clinic technics instruction was used for the first time in the United States at the 1953 Annual Conference for Veterinarians at Kansas State College, Manhattan. In left foreground (in white) is Dr. Jacob E. Mosier of the Kansas school. With back to camera is Dr. C. E. Hofmann, Tulsa, Okla. Two receivers, built by Prof. R. G. Kloeffler, head of the Kansas State Electrical Engineering Department, were used. Note remote control motors, floodlights, intent audience. Rooms in another part of the clinic housed the viewing screens.

In addition, the telecasts are most newsworthy and their impact on public relations is strong. The veterinarian has been portrayed in open-circuit telecasts to the general public, where his role in research, public welfare, and national defense has been presented.

The exciting prospect of learning by seeing is reflected in the surging interest shown in telecasting at each successive veterinary convention where it is used.

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Trichomoniasis should be suspected as the causative agent in all cases of pyometra in cows.—*E. A. Woelffer, Oconomowoc, Wis.*

Dr. Harry W. Orr Named Dean at Oklahoma

Dr. Harry W. Orr has been named dean of the School of Veterinary Medicine, Oklahoma A. & M. College, Stillwater, to fill the vacancy created by the retirement of Dean C. H. McElroy. Appointment was effective July 1, 1953.

Dr. Harry W. Orr

Doctor Orr was appointed to the faculty at the Oklahoma school in 1919 after his separation from the Army following World War I. He has held positions of assistant professor, professor, and head of the Department of Physiology and Pharmacology successively since that time. Doctor Orr has also served as a member of the Oklahoma Board of Examiners in the Basic Sciences since 1937.

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Disability Income Protection Insurance for Veterinarians

The original income protection insurance underwritten by the Continental Casualty Company for veterinarians in 1946 was sponsored and pioneered by the Illinois State Veterinary Medical Association and known as the Illinois Plan.

In 1949, the premium rate classification and underwriting provisions were revised to offer increased benefits at new low rates. With the elimination of the rated-up premium charges, the Continental Casualty Company issued the same policy benefits to veterinarians, at the same premium cost, as were issued to members of the medical, dental, and legal professions embraced in the Silent Partner Lifetime Income Protection Plan.

The Silent Partner policies require state sponsorship and are underwritten individually. These policies are now filed and approved in 31 states. The contract covers any total disability, on a loss-of-time basis, caused by confining sickness or accident for the duration of such disability. It also provides for partial disability payments due to injury and up to 60 consecutive months for every period of sickness on a no-house-confinement basis. Additional income replacement is provided when the insured is hospitalized, payable from the first day to a maximum of three months.

A step for increased benefits was taken when the National Committee on Insurance sponsored what is known as the Professional Association Plan, underwritten in policy GP-1309 (which is one of the companion policies of the Silent Partner Plan.) This policy is issued by the Group Department and is available by mail, nationwide, to all active veterinarians in good health under the age of 70 at the time of enrollment. It provides coverage for loss of time caused by sickness or accident, with monthly indemnity payable from the first day for 60 consecutive months, for each period of disability. Consecutive is held to mean non-aggregate; there is no limit on the number of claims. House confinement is never a requirement in order to collect full benefits. Additional income replacement of $10. a day is provided when the insured is hospitalized, payable from the first day, up to three months.

For the veterinarian under age 59 at the time of enrollment, the new Plan A schedule of benefits offers income replacement of $7,000. the first year, plus an additional $600. per month ($20. a day payable from the first day if hospitalized) up to 90 days providing a total of $3,400. in three months, and up to $32,800. the first "five vital years" of readjustment, then payment of $300. each month so long as such disability lasts. This schedule of benefits also provides for sickness on a no-house-confinement basis, payable from the first day with $1,400. for the first three months, $5,900. for the first year, and a total of $17,300. the first five years of readjustment.

The principal sum payable due to accidental death is $10,000. A special disability annuity of $10,000. is payable in cash, plus the above income replacement monthly indemnity for life covering the loss of hands, feet, or sight of both eyes. Maximum benefits payable in 20 years under the new Plan A total $86,000., and after 20 years, $300. monthly for life.

These facts have been provided by Mr. Peter N. Jans, author of the Silent Partner insurance plan for veterinarians and broker of record. For detailed information write to Mr. Jans, Box 824, Evanston, Ill.

PRINCIPLES OF ANIMAL HEALTH

R. R. DYKSTRA, D.V.M.
Manhattan, Kansas

Bovine Leptospirosis

Bovine leptospirosis may be the responsible cause of a sudden stoppage of milk secretion. The character of milk from diseased cows may be viscid and yellowish, resembling colostrum in appearance. Hemolysis in severe cases may impart a pinkish hue to the milk; in this latter event, urine may be wine colored. Udder changes are noninflammatory. This fact differentiates the condition from mastitis. The wine-colored urine is distinguishable from red urine due to free blood observed in pyelonephritis. Animals affected should be segregated as the specific causative organism is contained in the urine so that spattered droplets inhaled by nearby cattle may be a means of its transmission. Penicillin and aureomycin are favored in the treatment, but they are not specific.

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Chlorophyll for Canine Odors

In reference to the control of canine odors following the administration of water soluble chlorophyll, Worden and Waterhouse (*Vet. Rec.*, Sept. 28, 1952) found that halitosis (offensive breath) was controlled by giving 33 to 150 mg. daily to dogs weighing from 21 to 75 lb. Skin and coat odors and female sex odor, the latter during proestrum and estrum, were so negligibly affected that mating was not influenced.

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Transmission of Swamp Fever

It is becoming evident more and more that the transmission of swamp fever (equine infectious anemia) is not due to the ingestion of food or water contaminated with the virus of this disease, but rather by means of biting insects, particularly flies. Infected and susceptible horses kept together in screened enclosures for as long as four years has not resulted in transmission of the disease, though there was every opportunity for its spread by contaminated food. The virus also may be transmitted by any mechanical means that results in puncturing the skin. There is no exact method of diagnosing the infection in the carrier horse, nor is there an immunizing product of value.

Strain 19 Vaccine for Sheep and Goats

Is strain 19 vaccine an effective agent in the control of brucellosis in sheep and goats? This question was submitted in a letter requesting our opinion. In sheep, brucellosis is considered to be a self-limiting disease; it is not so in goats. Therefore, the control in sheep may be effected by segregation, while slaughter of infected goats is necessary. Strain 19 vaccine has not been shown to be of value in prevention of this disease in either sheep and goats.

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Strike in Sheep

In their research work, Synthetic Insecticides as Dressings for Blowfly Strike in Sheep, Doctors Toit and Fielder, as reported in the *Onderstepoort Journal of Veterinary Research* for December 1952, conclude that BHC, in its technical form, combined with clay as a wettable powder, readily dispersable in water at a concentration of 0.5% of the gamma isomer, yields ". . . 100% mortality of mature third stage larvae" of the *Lucilia cuprina*, and conforms most closely to the Lennox properties of an ideal blowfly dressing which, in general, are: Stability, resistance to decomposition, capacity to penetrate fleece easily and without damage to it, ready removal during the processing of the wool, ability to render larvae innocuous, non-toxicity to sheep, long residual effect, non-interference with healing, cheapness, ease of preparation by the addition of water to the solid components for aqueous preparations. The insecticidal effect of the BHC is slow, so that the majority of the larvae leave the wound before they are destroyed, thus there is no interference with healing.

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What is the cause of "deep spoilage" of beef? A recent report indicates that in practically normal animals the popliteal and prescapular lymph nodes were found to harbor quite a variety of anaerobic proteolytic organisms capable of maintaining their potency under a wide range of conditions. It has been hinted that these organisms are capable of originating "deep spoilage", especially when refrigeration of beef is inadequate.

POULTRY PRACTICE PROBLEMS

W. R. HINSHAW, D.V.M., Ph.D.
Frederick, Maryland

Paracolon Infection in Poultry

Paracolon infections are not uncommon in birds and especially in turkeys. Most of the outbreaks caused by this group of organisms belong to that described by Edwards, West and Bruner (*Ky. Agr. Exp. Sta. Bul.* 499, 1947) as the Arizona Group. Bruner and Peckham (*Cornell Vet.*, 42:22, 1952) have recently reported an outbreak in poults caused by one designated as Ar. 7:1, 7, 8, by Edwards, *et al.*, in the above reference. The outbreak was acute and involved 2,500 poults. It is of interest that the Arizona type isolated by Bruner is the same as that described by Hinshaw and McNeil (*Jour. Bact.*, 51:281 and 397, 1946) from rattlesnakes and turkey poults. At that time the Ar. 1:1, 7, 8 was called PC type 10 according to Edwards, *et al.*, (*Jour. Inf. Dis.*, 73:229, 1943). This organism is known to be transmitted in eggs, and produces a disease clinically indistinguishable from pullorum disease.

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Effect of Hot Weather on Laying Hens

Temperatures above 100 F. early in the season often prove disastrous to chickens (Wilson and Houck, *Nulaid News*, 31:5 [June], 1953). Later, according to these investigators, birds may become accustomed to the heat and endure high temperatures with little or no death loss. The temperature requirements for birds differ with age, according to Wilson (*Nulaid News*, 30:25 [Dec.], 1952). Proper temperature for brooders is around 95 F. As they grow they survive best at 60 to 70 F., while adults do best at temperatures from 40 to 70 F. Hot weather has many ill effects on chickens, chief of which are: (1) lowered feed consumption; (2) severe illness and oftentimes death; (3) lowered egg production; and (4) decreased egg quality because of thinner shells and smaller sizes. In previous work at the University of California, Wilson showed that chickens could not tolerate air temperatures of above 105 F. for longer than five hours. Body temperatures of birds exposed in these experiments began to rise when the air temperature reached 85 F., and the rise became marked at 90 F. Water consumption at 95 F. was double that at 70 F.

Wilson and Houck suggest cooling poultry houses by water as a means of preventing heat losses. Their systems apply principally to areas of high summer temperatures with low humidity, and where there is some air movement. Three distinct methods of cooling poultry houses are described by them. These are: (1) roof sprinkling, (2) mist spraying inside the house, and (3) use of sprinklers chiefly for growing vegetation between pens.

In emergencies, one can use a garden hose and a fine spray-type nozzle to spray a stream of water directly on the birds. Prompt treatment by cooling affected birds will usually prevent death losses, but once a flock is overcome by heat, egg production may be affected for several days or even weeks. An ample supply of cool water at all times, properly ventilated houses and nests, and protection from direct sun will aid in preventing losses. The use of some type of sprinkling system, as described by Wilson and Houck, during excessive heat waves should be considered in areas where applicable. See *Veterinary Medicine*, 43:414 (Oct.), 1948 and 46:458 (Nov.), 1951, for additional notes on this subject.

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The first mammoth incubator to be successfully used for hatching chicken eggs was manufactured and operated in 1913 by Dr. S. B. Smith in Cleveland, Ohio. Three years later a handful of commercial hatcherymen organized the International Baby Chick Association to combine their forces to develop new ways of merchandising and distributing baby chicks. This association, now known as The American Poultry and Hatchery Federation, has permanent headquarters in Kansas City, Mo. On its membership list are approximately 5,000 of the total of 9,000 hatcherymen in the United States. Besides serving the hatchery industry, the organization, through its Research Committee, sponsors grants-in-aid to educational institutions. In 1952-53, these totaled ten projects, amounting to $16,500.—*Hatchery and Feed*, Oct., 1952.

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The North Dakota Agricultural Experiment Station reports that waste feathers can be converted into a valuable organic nitrogen fertilizer.

Use of Curare in Horses: A Clinical Report

A. DONALD RANKIN,* D.V.M., M.S. and HARRY W. JOHNSON,** D.V.M.

After watching the demonstration by A. D. Rankin and N. H. Booth on the use of curare in horses, at the 14th Annual Conference for Veterinarians at the School of Veterinary Medicine, Colorado A. & M. College, Ft. Collins, it occurred to one of us that this was an agent that would meet many of the practical problems in restraint of Thoroughbred and other purebred horses. In the control of these animals, it is desirable that they do not gall themselves or fracture any bones while being cast. This is a report of the use of curare as an aid to restraint during castration of seven hunter type horses and the dental care of one Thoroughbred stallion.

The drug used was a *d*-tubocurarine chloride preparation† containing 100 units per cc. which was injected intravenously without dilution. Using the study of Booth and Rankin[1] as a guide, the dosage scale was started at 0.2 units per lb. body weight on the first horse and raised to 0.35 units per lb. for all others except one. All of the weights were estimated. Injection was made as rapidly as possible (2-5 seconds) using a 5 cc. syringe and a 20-gauge, 1-in. needle. If the horse did not drop in three minutes, an additional amount, estimated according to the response to the initial dose, was injected intravenously as quickly as possible.

When it was necessary, artificial respiration was administered as described by Rankin *et al.*[2] This has been found to be the most satisfactory antidote for curare in the horse. It was found that if four or five minutes elapsed after the injection of curare without respiratory embarrassment, animals had no further trouble. The Thoroughbred and one hunter held their breath after the five-minute period but resumed respiration as they became hypercapnic. When the animals dropped, their forelimbs were tied with a tomfool's knot[3] drawn up to their chest, and secured. (No further restraint was applied to the horse on which dental work was done.) In those animals which were to be castrated, the upper rear leg was immobilized with a figure-eight tie[3]. For a monorchid (unilateral abdominal cryptorchid[4]) castration, both rear limbs were secured with figure-eight knots. All horses fell easily and without abrasions. There was apprehension in only one animal before going down. Although there was some struggling during the castrations; violent, convulsive muscular contractions that usually occur were not present. After the surgery was complete and the limbs released, the animals laid quietly until they stood up. They all gained their feet without unsteadiness. There was no depression following the use of the drug as it is not an anesthetic agent but a muscle relaxant.

Case 1. Yearling stallion, hunter type. Estimated weight 550 lb. Horse was given 110 units of tubocurarine chloride (0.2 units/lb.), intravenously. Slight trembling was noted in two minutes. Five minutes after the first dose, 110 units more were administered. In 6.5 minutes after the first dose the horse fell, was secured, and castrated. The animal stood and walked off 17 minutes following the first dose.

Case 2. Yearling stallion, hunter type. Estimated weight 600 lb. Horse was given 210 units (0.35 units/lb.). This patient fell one minute after the injection, exhibited slight respiratory embarrassment but was not given artificial respiration. After castration, the horse was on his feet and steady 11 minutes following injection.

Case 3. Yearling stallion, hunter type. Estimated weight 600 lb. Horse was given 180 units (0.3 units/lb.). Two minutes following the injection there was slight trembling and in eight minutes an additional 150 units were given. This yearling fell and became asphyxiated in two minutes and was given artificial respiration for two minutes. After respiration was resumed, the horse was castrated. The animal was on his feet 28 minutes following the first injection.

Case 4. Yearling stallion, hunter type. Estimated weight 550 lb. Horse was given 190 units (0.35 units/lb.). Slight trembling was observed in 1.5 minutes. In 3.5 minutes an additional 60 units were given, and 1.5 minutes later the animal fell. There was slight cyanosis. This animal was castrated and back on his feet 12 minutes following the initial injection.

*Department of Physiology, School of Veterinary Medicine, Colorado A. & M. College, Fort Collins.

**Howarth and Johnson Animal Hospital, Littleton, Colo.

†Tubocurarine chloride, injection, high potency—supplied by E. R. Squibb and Sons, New York.

Case 5. Yearling stallion, hunter type. Estimated weight 425 lb. Horse was given 150 units (0.35 units/lb.). There was slight trembling manifested. Three minutes following the initial dose 50 units more were given; the patient fell in one minute. Castration was completed and the horse standing 12 minutes after the initial injection.

Case 6. Yearling stallion, hunter type. Estimated weight 600 lb. Horse was given 210 units (0.35 units/lb.). This patient fell in two minutes, was castrated and back on his feet 10 minutes following the injection.

Case 7. Two-year-old stallion, hunter type. Estimated weight 900 lb. Horse was given 310 units (0.35 units/lb.). This stallion was found to be a monorchid so both hind legs were secured. The testicles were removed and the horse was standing 20 minutes following the time of injection.

Case 8. Eight-year-old stud, Thoroughbred. Estimated weight 1,110 lb. This stud was extremely nervous, head shy, and had shown signs of viciousness. He had to be placed in stocks to prevent rearing and striking. A total of 390 units (0.35 units/lb.) of curare was given; two minutes later this stud fell, showing respiratory embarrassment. Artificial respiration was given for about four minutes. It was difficult to determine whether ventilation was required all of this time for when control of the respiratory muscles was regained the animal would hold his breath until becoming very cyanotic. After floating the teeth, he sulked and would not stand until urged 23 minutes following the injection.

Summary

1. A method of restraint for horses is described which reduces the labor involved and the risk of injury to the veterinary surgeon and to the horse.

2. Individual case reports on the use of *d*-tubocurarine chloride in eight horses under field conditions are described.

3. In the opinion of the authors, the procedure is a safe, convenient, and professional method of handling horses.

Editor's Note. It should be emphasized that the effects of a paralyzing dose of curare might be mistaken for a state of anesthesia. Curarized animals are completely conscious of pain, yet cannot struggle or cry out. This drug affects only the motor end plate of the sensory-motor arc, thus paralyzing the nerves of motion but not those of sensation. When used in conjunction with anesthesia, care must be taken that a relaxing, not a paralyzing, dose of curare is given so that depth of anesthesia can be determined by means of usual indexes.

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Canine Dermatoses

T. A. NEWLIN, D.V.M. and
H. J. MOSTYN, Dover, New Jersey

Such morphologic and out-of-date names as erythematous eczema, vesicular eczema, chronic eczema, and summer eczema are not sufficient to identify the disease and to satisfy the need for interpretation. Eczema is defined as dermatitis of unknown cause. Dermatitis always has a cause, although this may be extremely difficult to identify. Merely to call it erythematous eczema at one time and summer eczema at another would imply failure to comprehend the phenomena manifested.

Lesions the patient inflicts upon himself are to be considered of importance. These are common to all cases of itching eruptions of the skin regardless of what area of the body is affected.

Contact dermatitis frequently becomes complicated with parasitism and it is such combinations which comprise confusing cases once called eczema. This type of skin condition appears more frequently in summer than in the colder months of the year, hence the adoption of the term "summer eczema." Mechanical irritants, in cases where dogs are clipped of their protective coat in the summer, contribute to increased incidence of dermatitis at this time. Contact dermatitis is never primarily pustular; secondary infection from skin flora, aided by the dog's scratching, sometimes results in formation of pustules. Dermatitis is only allergic if it is a result of an induced generalized sensitivity. Skin, in which the defense mechanism has been impaired is, of course, more vulnerable to the action of primary irritants.

The basic principle in treatment is to remove the cause. One must give the animal symptomatic relief while the skin heals. Effort

should be directed at keeping irritating medicinals off the skin as harsh preparations can not force or assist in healing injured tissues. There are many ointments which increase irritation to tissue. These are to be avoided; the employment of certain ointments — such as ammoniated mercury, sulfonamides, and those containing antibiotics — has been observed to abet staphylococcic invasion by reason of the mechanical effect.

A study to determine the efficacy of a lotion containing chlorinated cod liver oil, zinc oxide, talcum, lanolin, and petrolatum was undertaken in the early summer of 1952. Prior to that time we had been using the same ingredients in the form of an ointment, available under the trade name desitin® ointment. In the human field, this had proved efficacious in the treatment of non-specific dermatitis, and as a dressing for wounds, burns, and ulcers.

For the sake of brevity, and to avoid being repetitious by reporting each of the 28 cases in this series, it was decided to summarize the results without consideration of the etiological factors involved in each case history. The major portion of the cases treated were of the chronic vesicular type of dermatitis involving the more common areas of chest, neck, tail, back, and in the region of the mammae and genitals. One case of follicular mange, confined to the occiptal region of the head, was not confirmed until after the desitin lotion had been applied. Surprisingly, after 24 hours, no further mange mites could be found in the affected lesion.

All cases, with one exception (that of an elderly bitch which had a mycotic complication) responded to the therapeutic action of this lotion in a most striking manner. The periods of healing for all lesions to which it was applied, were reduced by the rapid astringent action, and the arrest of pruritus was evidenced by the animal's failure to scratch.

▼ ▼ ▼

Secretary of Agriculture Ezra Taft Benson has proposed that modified live virus vaccine, used in conjunction with specified amounts of hog cholera antiserum, be permitted for the immunization of swine moved interstate. Regulations now in effect provide for use of serum and virus.

Proposed amendments have been submitted for publication in the *Federal Register* and comments concerning them may be filed with the Chief of the Bureau of Animal Industry, USDA, Washington 25, D. C., within 30 days subsequent to date of publication.

®Desitin Chemical Company, Providence, R. I.

Veterinary Public Relations

(*Continued from page 332*)

dent of their absolute honesty and trustworthiness. When these things are assured, the veterinarian will assume, in the opinion of the public, the position accorded any person, in any profession, possessing these qualifications.

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Disease diagnosis and medication are clearly the veterinarian's legitimate field of activity and his to retain through his record of performance.

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Toluene for Dogs and Cats

(*Continued from page 328*)

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BOOK REVIEWS

Books reviewed in this department and any other books, if available, may be obtained by remitting the published price to the Book Department, Veterinary Medicine, Suite 803 Livestock Exchange Building, Kansas City 2, Missouri.

HOBDAY'S SURGICAL DISEASES OF THE DOG, a text and reference by *Frederick Hobday,* C.M.G., edited by *James McCunn,* M.R.C.V.S., M.R.C.S., L.R.C.P., professor of veterinary anatomy, Royal Veterinary College, London. 453 pages, illustrated. 6th ed. Williams and Wilkins Company, Baltimore, publishers, 1953.—Price $6.50.

Hobday's Surgery has been a standard text for students and a popular reference work for practitioners since 1900. It has enjoyed widespread circulation not only throughout America, but in other countries as well. The clarity of the surgical indications, as well as the descriptions of technic, are noteworthy features.

The text conforms to American veterinary practices in most respects and has been thoroughly edited and supplemented. Interesting paragraphs are those on application of artificial eyes, local dental anesthesia, patterns of artificial limbs, and use of radium. Many of the old cuts have been revised but some depict out-of-date equipment. New photoengravings would have given added illustration value.

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INDEX OF DIAGNOSIS, CLINICAL AND RADIOLOGICAL, FOR THE CANINE AND FELINE SURGEON, by *Hamilton Kirk,* M.R.C.V.S. 667 pages, 326 illustrations. 4th ed. Williams and Wilkins Company, Baltimore, publishers, 1953.—Price $8.50.

Earlier editions to this, the fourth rewriting of Kirk's Diagnosis, were reviewed in some detail when published. Readers are referred to *Veterinary Medicine,* 34:458 (July), 1939; 40:325 (Sept.), 1945; 43:126 (Mar.), 1948.

The value of this work is apparent from the demand for copies in all countries of the English-speaking world. Four editions, and one reprinting of the third, since 1939 attest to the acceptance of it by practitioners and students. Revision of this edition has been considerable, incorporating much new material covering the subjects of virus diseases, fracture fixation, and numerous other subjects about which new information has accumulated in the last two or three years.

This edition also features the differential diagnostic tables found so useful in previous ones. The section on *x*-ray diagnosis has been enlarged and thus made more comprehensive, as have those devoted to leptospirosis, hard pad disease (which the author prefers to term paradistemper), infectious hepatitis, and others.

Written by an English author who is an eminent authority, Kirk's Index of Diagnosis conforms to generally accepted principles and methods employed by American practitioners. The book should prove helpful in making a correct diagnosis and thus assist clinicians in applying specific procedures.

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Toxic Aspergilli

(Continued from page 324)

Further studies are in progress. At this time, it is premature to assess the relationship of these results to bovine hyperkeratosis, but results obtained so far indicate possible relationship.

Summary

Three species of Aspergilli were isolated from a food concentrate used by various workers to produce hyperkeratosis in cattle. Ether extracts from the food concentrate and from bread on which the three Aspergilli had been cultured produced inflammatory dermal reactions on rabbit and calf.

Bread on which one of the Aspergilli had been cultured, when administered in an aqueous slurry by stomach tube, caused death of two calves. Lesions produced were characterized by extensive hemorrhages of the trachea, lungs, liver, pancreas, kidneys, heart, adrenals, and intestinal tract. Degenerative changes were observed in the liver and kidneys.

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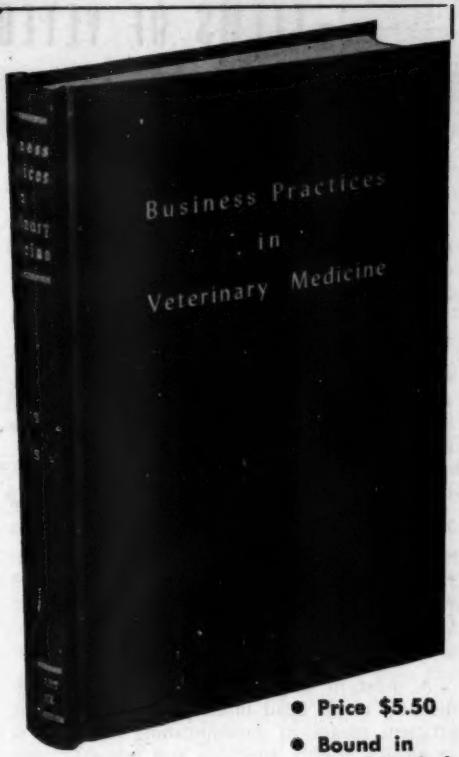

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ITEMS OF VETERINARY INTEREST

Nova Scotia has had no pullorum reactors for five years. Latest tests included 81,357 birds.

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The newly enacted Durham-Humphrey Act should tend to minimize home medication and encourage cooperation on the part of the owner.

▼

Moormann reports a case of *Fasciola hepatica* occurring in a child (*Med. Klin.* 45:4, 1950). Fascioliasis may become an increasingly important public health aspect in the future.

▼

The only cause of bovine hyperkeratosis, or X disease, of cattle which has been proved and confirmed, is highly chlorinated napthalene, and compounds which contain them either as an added ingredient or as a contaminant.—*USDA.*

▼

A must in poultry sanitation is the daily disposal of all dead birds. One of the most efficient means of accomplishing this task is to have a readily available and properly constructed disposal pit (See *Vet. Med.*, 45:424 [Oct.], 1950).

▼

Nerve stimulation, caused by manipulation in the laryngeal area, is thought to be the cause of sudden cardiac arrest during surgery, particularly under light anesthesia. This is commonly caused by tracheal intubation, resulting in a reflex which causes release of epinephrine which in turn is responsible for ventricular fibrillation and ultimate arrest.—*Report, General Surgery Committee, A.A.H.A., 1953.*

▼

Chickens experimentally fed extract of ground brains show sustained reduction in blood cholesterol, a substance suspected of causing hardening of the arteries. The reduction was roughly proportional to the dosage of the extract and prevented the hardening process for as long as five weeks. It is believed that some chemical in the brains converts cholesterol into a stable compound given off as body waste. These findings are of potential importance in treatment of arteriosclerosis and coronary thrombosis of man.

There is no substitute for a prompt and accurate diagnosis as the basis of effective treatment.

▼

Tuberculosis in cattle has been reduced to the point that only one affected animal is now found in approximately 1,000 cattle tested.—*A. K. Kuttler, D. V. M., Washington, D. C.*

▼

Incidence of Rabies in the United States, 1952

Statistics on the number of cases of rabies in the United States in the calendar year 1952 have been collected by the Bureau of Animal Industry of the U. S. Department of Agriculture.

There were 8,453 cases reported: 5,261 cases in dogs, 916 in cattle, 38 in horses, 19 in sheep, 31 in swine, 486 in cats, seven in goats, 1,674 miscellaneous, and 21 in man.

This material was compiled from a questionnaire sent by the Bureau to the livestock sanitary official and the health officer in each state. In some instances, data from both sources in a state were used. When there was a difference in the number of cases reported for the same species, the greater number was used, since it is believed that the reported cases do not represent all that occurred.

Texas reported the greatest number of cases (1,415), 1,047 of which were in dogs. Tennessee reported 546 cases, Alabama 535, Virginia 476, Georgia 436, and Kentucky 399. These states generally outline the region of the United States in which the incidence of rabies is highest.

New York reported 174 cases in cattle, the greatest number for cattle included in state reports, and 112 cases in the miscellaneous category, including wild animals. Only 17 cases of the disease in dogs were reported as confirmed in New York.

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